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The Tank Block Problem

Various Phases Discussed Throughout the Industry

THE intense significance to the glass industry of the problem of improved refractories for use in melting tanks is clearly demonstrated in the country-wide discussion aroused by the description, printed in the November issue, of the development and testing by a well-known glass manufacturing concern of a mullite block possessed of unusual refractory qualities.

For many years there has been issuing from the manufacturing section of the glass trade a vociferous and most insistent cry for better tank blocks. The revelation of the fact that one of their own number has successfully solved the problem in its own glass works has been received by manufacturers everywhere with keen interest, in some cases with enthusiasm; but as is natural under the circumstances, many questions have arisen since the news became known, as to what changes in the industry would follow the general acceptance by glass manufacturers of a superior type but more costly block.

Among the questions publicly discussed has been one as to whether the refractories heretofore and now in use are suited to the glass manufacturer's needs, whether he desires a higher grade refractory than that used in the past, and whether he will be willing to pay more for a higher grade refractory than he pays for refractories at present.

Believing that the glass manufacturing industry in general is rapidly becoming one of the most progressive in any field and that it would gladly co-operate to test out any innovation that promised to lessen or eliminate serious production problems and bring manufacturing costs to a lower level, GLASS INDUSTRY submitted to a score of well-known representative manufacturers the following communication:

> "Recent announcements by several concerns of the successful production of long lasting mullite tank blocks is causing wide discussion. The question has been raised publicly as to whether manufacturers really want more durable blocks if larger initial investment is required than for present blocks.
>
> "To confirm or refute the existence of this seemingly unprogressive attitude we desire evidence of the sentiment of the trade toward the introduction of improved blocks at prices based on performance.
>
> Will you kindly give your views on the situation?"

The results of the inquiry are interesting. The answers are given below. They reveal a strong tendency throughout the trade to follow progressive policies.

Are More Durable Tank Blocks Wanted?

By S. R. SCHOLES
FEDERAL GLASS COMPANY

The recent successful experiments in casting tank blocks of fused mullite, resulting in blocks of greatly increased resistance to corrosion, have raised the question of how far glass manufacturers would be willing to go in buying these superior blocks.

The answer to this question is to be sought from the cost accountant, rather than from the technologist. However, a statement of the related factors entering into the problem of profitable investment in furnace walls may be of assistance. Therefore, without posing as an expert on costs, the writer ventures to offer a discussion of the question.

To rebuild the side-walls, in both melting and working ends of an average tank of 30 tons daily capacity requires about 30 tons of blocks, costing $1,800. Other refractory items, such as fire-brick, air-space covers, tuck-wall, silica, etc., may be estimated roughly at $1,000. Labor costs $1,000 more, making a total repair cost of $3,800. The firing of a new tank and bringing it up to heat, filled with glass and ready for work, may be placed at $1,200. Replacing iron work, wind lines, piping and machines ready to resume operations, is worth at least $500. The assumption is made that a spare tank is brought into service as soon as the tank to be repaired is let out. Otherwise the matter of several weeks' lost production enters in to complicate the problem.

Summing the above listed items, we have a total of $5,500. From this tank, with the best blocks now on the market, we may expect a life of 300 working days. This shows a daily cost for "tank rental" of $18.33.

A fair estimate of either the cost per ton or the longevity of mullite blocks cannot now be made, but let us assume each at three times that of the present flux block. That is to say, blocks costing $180 per ton would last three years, or 900 working days. Inserting these numbers in the example worked out above, other costs being stationary, we obtain:

Block cost (neglecting increased weight of denser blocks)	$5,400
Brick and Refractories	1,000
Labor	1,000
Firing	1,200
Replacing Machines, etc.	500
A total of	$9,100

for 900 days' service, or a "tank rental" of $10.11 per day. On this basis, it would appear that the cost of tank up-keep would be practically cut in half by the use of superior, although costly, blocks.

But a number of considerations at once crowd for attention. What of the fire brick or silica used in ports and up-takes? Will the cover-stones on the air-space last three years? Must bottom blocks also be made from more expensive material in order to outlast side-walls? What kind of tuck-wall construction, and of what material, will be required? Are silica jam-walls good for three years? And finally, if the slagging and batch-dust accumulation in checkers becomes troublesome in one year, how will it be taken care of in a three-year run?

These questions are not to be answered off-hand. Several may be settled by saying that better refractories can be used, to restore the balanced life now obtaining, in tank construction. Perhaps checkers must be re-set under a hot furnace, or during a brief shut-down—a terrible job, but not impossible. All these matters must wait for experience.

One interesting thing to be hoped for would be, that the elaborate wind-cooling now deemed essential to prolong the life of side walls might be abandoned. The consequent saving in power and equipment would be relatively great.

On the whole, it is the writer's opinion that the purchase of improved tank blocks, at a cost in proportion to their durability will be found to be profitable.

Other Replies to the Tank Block Question

From a large company operating several plants:

"Our general attitude is that we are willing to pay more for a long service block than a short life one.

"Cost of block and replacements to a manufacturer cannot be pro-rated according to the months of life. Granted that the average tank now lasts only eight months, though we have been able to make some of the tanks last longer by unusual work, the credit should not go to the block. Comparing an eight-months block with a 16-months block, cost data should include not only the length of service and price of the block, but also the per annum per cent of construction work on the tank. This should include superstructure as well as below the glass line. Overhead charges should be pro-rated as well as loss in production.

"You can readily see that these factors vary in different factories and occasionally might be influenced by the necessity of turning some tanks out on account of lack of business."

From Southern New Jersey:

"We are continually looking for improved tank block and are greatly interested in mullite block. We would consider an increased price a secondary matter compared to getting better quality with longer service."

From a large Ohio plant:

"As to the field for long-lasting mullite tank blocks we feel that the glass manufacturers are naturally skeptical and conservative about adopting anything new until they have an experience factor to guide them. This situation seems to be somewhat comparable with the use of iron or steel in construction work or adopting brass and copper. One man will put in all iron or steel plumbing and galvanzied screens while another will use brass piping and fittings, copper downspouts and copper screens, figuring that the longer life justifies a higher initial material cost. In most cases the more lasting brass and copper is probably cheaper in the long run.

"Manufacturers cannot afford to speculate but must feel satisfied that an increased investment will result in lower overall costs and that the new blocks are uniformly superior in their behavior and not erratic in their performance. Our opinion is that where there is a sufficient volume of business to promise continuous uninterrupted production that high priced refractories would be economical to use if the claims made for them are confirmed by experience."

A big California bottle plant.

"This company would not hesitate for one moment to pay high prices for tank blocks of greater endurance making payment of excess dependent upon improved performance. Any that would reject such proposal from a reputable concern with fair prospect of success does not correctly locate point of great available improvement in manufacture costs."

Maryland strong for it!

"Regarding mullite tank blocks we desire to emphatically state that we are *very much interested*. The price based on performance would be no hindrance to our purchase. If such blocks are on the market we will give an immediate order."

From the maker of a well-known special glass product:

"The ——— Company is progressive in its ideas and is interested in better tank blocks. Price is not a factor if we can increase the life of our tanks. We have made some experiments in our plant recently which have proven to us that better tank blocks can be produced."

From one of the greatest of glass-making concerns:

"About improved refractories for the glass trade, we give our opinion as follows:

"1. More durable tank blocks are urgently needed in our industry.

"2. For better blocks a somewhat higher price may be warranted."

From a President, the head of four plants:

"There is only one answer to the question you put if the manufacturer bears in mind the great saving on a tank block that has from 25 to 100 per cent longer life; in other words, if a tank block will stand up twenty months or more, the addition in cost over a cheaper block that may only stand ten or twelve months would be a great saving to the manufacturer."

From New York State:

"We think that a tank block which would have a longer life than those now being made, would be of great benefit to the glass industry, and that price based on the number of months they would last, in comparison with price of present blocks, should be satisfactory to the tank block users.

"The reason for this is that there would be less loss of production, due to frequent repairs, on account of tank block failure."

From Illinois:

"We know nothing of the successful production of long lasting mullite tank blocks. It has never been brought to our attention in a practical way. Of course, we have read from time to time in the technical papers of various fire resisting materials having been tested for tank block purposes, but since there has been no departure from the old-time custom of using clay blocks by the glass industry we take it for granted that nothing really practical has yet been discovered. However, there is no question to our mind but what the progressive manufacturers want more durable blocks than what is being used at present and would gladly pay a larger initial investment so as to preclude the necessity of changing those blocks and often terminating fires at the most

inopportune time. We certainly resent the allegation of being seemingly unprogressive because such is not the case and whenever improved blocks are available at prices based on performance, we will be very glad to try them.

"We might state that there has been considerable improvement in the construction of glass factories in the last twenty years even though clay blocks around the tanks are still in general use, and that progress is reflected in the larger quantities of glass now being melted and the duration of a furnace as compared to what was the case twenty years ago. For upper structure work new products such as corundite and silica products are in use and add a great deal to the life of a furnace so that if eventually a better material takes the place of the present flux blocks we will have furnaces that will last almost indefinitely."

Another big bottle plant:

"We would be interested very much indeed if we could obtain tank blocks that would last three times as long as our present material, and the increased cost of the new tank blocks would be a small item in comparison with what we would gain with tank blocks lasting three times as long as our present, as you can appreciate, no doubt, what the loss of machine hours is on three tank repairs, which would mean anywhere from at least four weeks and many times running into eight weeks' lost time, and also the terrific cost of labor in making these repairs in addition to the cost of the material. So in conclusion, we would certainly welcome any new idea in tank blocks that would prolong the life of our tanks two or three times what we are getting with the present material."

Mullite Refractories

[Review of a Paper Presented by T. S. Curtis, Director of Research of the Vitrefrax Company of Los Angeles, California, Before the Pittsburgh Branch of the American Ceramic Society at the Mellon Institute, November 3, 1926]

By L. S. Longenecker*

Mr. Curtis introduced his subject with a brief review of the earlier fundamentals underlying the study of sillimanite. About as early as 1919, his company became very much interested in what was then considered as sillimanite proving a remarkable refractory material. About one year was spent in experimenting with the old theory of an alumina silica ratio of 63 to 37 per cent. Another year in working along the lines of increasing the alumina content in order to get rid of the glass around the crystals. In the early part of 1922 a series of melts were made in order to find the most stable compound of alumina and silica. The results showed the most satisfactory ratio to be 72 alumina to 28 silica. These results were secured by a more or less rule of thumb method, however very well confirming the more scientific works of Wilson and Sims, and Bowen and Greig, in which they identify this 3 to 2 ratio as mullite.

Further test soon showed this 3 to 2 ratio (mullite) to be the most satisfactory compound of alumina and silica and yet not the best refractory. Experience of making this material into brick showed that any appreciable magnesia content promoted a too great fluidity of the glass surrounding the crystals, also that lime was even more harmful in this manner. Potash proved not so harmful and in some cases of some help.

Brick that were made of 100 per cent of electrically fused mullite grains (72 Al_2O_3-28 SiO_2 ratio) produced very unsatisfactory service results in boiler setting, forge furnace, etc., actual furnace installations, to such an extent that the hope was abandoned of using this electrically fused mullite for such refractory purposes.

In making an electrically fused mullite, the material will come out a solid cake and on crushing this down suitable for making refractory shapes, it was found that the crystals would break down also. By proper screening and separation the crushed cake was found to contain 80 per cent mullite and 20 per cent corundum and glass, the one a very highly refractory material and the other a very low one, fusing at about cone 12. Brick made up of this mullite grain kiln-marked considerably and had a rather low load test. This trouble was found to be due to the weakness of the glass matrix surrounding the pure mullite crystals.

Conclusions were reached and plans made that this weakness may be overcome, if by some way this glass could be strengthened and stiffened up with finely divided mullite particles. Tests were conducted on specially calcining high alumina clay, etc., in order to produce a mullite material with the glass more thinly and better divided in and about the mullite crystals. It was found that suitable clays could be satisfactorily calcined at cone 32 and the grains would not stick together in a sintering test. Brick made from these materials would not kiln-mark and also showed a much higher load strength.

A SERVICE INSTALLATION
Showing the comparison between a mullite (Durox) tank block section and a clay block at the end of a campaign, making window glass.

About the middle of 1923 the petrographic study of the crystal structure of these calcined bodies was engaged in as a

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means of learning their characteristics. It was found that the structure was an interlocking arrangement of mullite crystals surrounded about with a glass. The glass was more thinly divided and spread film-like over the crystals and was partially stiffened up by mullite needle-like crystals. This calcined mullite proved a better refractory material, and the problem was now to properly bond a brick made from the same. Mr. Curtis remarks here that he is not in a position to tell the means by which this material is now successfully bonded. The actual service records of this type brick show that it is the best refractory for boiler settings, forge furnaces, etc.

In working up this brick so that it would best meet the West Coast furnace conditions, the following were some of the points necessary to consider. Oil is a main source of fuel and it generally carries a high content of sodium chloride which is a tough flux. A refractory had to resist this fluxing and penetration. Then, too, according to operating practice, severe thermal shock is quite common and the brick had to possess enough elasticity to withstand this punishment. Beginning with a vitreous grog which will resist the sodium slag, properly sizing and filling in the pore spaces with smaller particles and properly bonding with a bond that will act as a painted coat over the grog particles, produced a proper brick for this type service. Under reducing flame conditions, this type brick also is best as the gases are less harmful on vitreous than porous grog particles.

Possibly the reader is now of the opinion that the electrically fused mullite has been completely given up in favor of the calcined material. Not so, as attention is now recalled to the electrically fused material as the proposition of glass tank blocks is treated. This scheme of what has been considered good on general refractory work is about all wrong on glass tank blocks. Experience showed that molten glass will erode away any amorphous bond and the grog grains will go into the glass. We are now back where we want a refractory structure of interlocked mullite crystals interspersed with a glass as a matrix.

You all know that a lump of sugar will readily dissolve when dipped in hot water; disintegrate no doubt, since the sugar particles are simply held together by their corners. Now, if you fill in this pore space of this lump of sugar with paraffin, it will dissolve very much slower as the dissolving occurs on the face only. The same behavior is somewhat similar in glass tank blocks. To best resist the dissolving effect of molten glass, a tank block must have as low a porosity as possible and these pore spaces scattered throughout in a very fine sprinkling in place of a less number of larger pores. Also, this tank block must be of such composition that it will build up a stiff or viscous protective coating on its exposed face.

The composition of this type tank block is a structure of mullite crystals, in a large cornered grain form. The pore spaces between these grains are filled in with fine needle-like mullite which thickens up the surrounding glass. In making the porosity test of these blocks, glycerine has been substituted and used in place of water for the reason that it comes the nearest to molten glass in viscosity. When using water, the average porosity of the blocks was found to be between 11 to 14 per cent, and the same blocks with glycerine showed what is termed an "active" porosity of 2 to 4 per cent.

Mr. Curtis concluded his paper here with the remark that he could furnish ample service results of these glass tank blocks in operation. But as this may border on the verge of advertising, he refrained from presenting the plant service feature.

Review of General Discussion

Discussion of the paper was lively and keen and engaged in by a big percentage of the seventy members present.

"How did you check up the viscosity of glycerine with molten glass?"

"No technical test or studies were made to check up this matter. Deduction showed that the blocks worked against a more viscous material than water, and that glycerine appeared to best meet this likeness. The water goes right through the block, while the glycerine penetrates only the *active* pore section of a block and gives the porosity of that skin section. In service the molten glass most certainly does not penetrate a tank block through and through like water, but only partially penetrates the exposed face of a block somewhat like the glycerine test. Numerous tests made on actual test samples have greatly confirmed our belief in this type porosity test for glass tank blocks."

Several members then commented on the more nearly fairness of the glycerine method of determining the porosity of the tank blocks as compared with the water porosity. The point was made that the penetration is not alone dependent on the viscosity but also on surface tension, etc., since water does not represent any likeness to molten glass in these respects. The conclusion was stated that water was of no use in determining the porosity of a tank block. Several remarks indicated that even a more viscous material than glycerine might prove a more proper porosity test.

"How is the conductivity of mullite tank blocks?"

"It is a bit higher than clay blocks. At present this is overcome somewhat by building a 12-inch thickness of wall by a compound thickness of 8 inches of Durox backed up with 4 inches of clay brick or blocks. Actual tests over an equal period of time on the above type compound wall and a full 12-inch thickness of mullite blocks have shown no decided service advantage to the full 12 inch thickness. The compound wall is thus the cheaper in material cost and equal in service and is no doubt the most economical installation."

"Any throat tests?"

"Yes, we have mullite throat stones in service to date two year and two months, making bottle glass. A 12-inch thickness of mullite block installation is now in its third campaign in a day tank making window glass."

"Any experience with fluoride opals?"

"Yes, some experience and the results have been very satisfactory."

A New Ultraviolet Transmitting Glass

Corning Glass Works Preparing for Quantity Production

By H. P. Hood*

Numerous attempts have been made toward the development of glasses, or suitable substitutes, capable of transmitting ultraviolet radiations shorter than the region neighboring 300 $\mu\mu$. The number of possible applications for the use of ultraviolet light, especially full sunlight, has increased markedly during recent years and it has been the absence of materials of a required transparency within a reasonable price which has been largely responsible for their retarded development. Fused quartz glass possesses high transparency, but even with the great improvement in manufacturing methods the cost of covering a limited area is high. C. Fritsch has described a glass of boric oxide and fluorspar which is claimed to transmit the 185 aluminum line, F. A. and C. L. Lindermann prepared a lithium borate glass showing no appreciable absorption above 200 $\mu\mu$. In publishing the results of experiments leading to the development of Uviol, E. Zschimmer gives glasses transmitting to 186 $\mu\mu$. In general, however, the glasses showing a marked increase in ultraviolet transparency over ordinary glasses sacrificed a great deal in resistance to weathering, or were melted under conditions which were impractical in general production. Hence no glasses other than quartz showing a high transmission in the region of 290 $\mu\mu$ were commercially available.

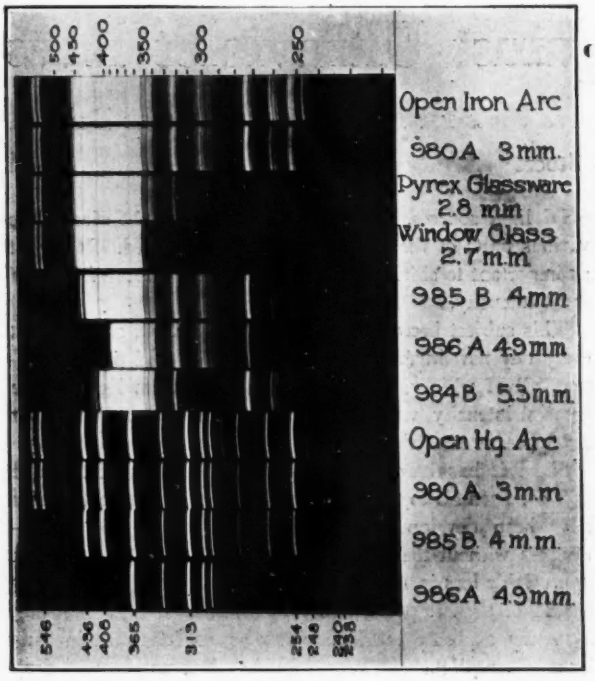

FIG. 1.
The transmission of 980A and other glasses for ultraviolet radiation from an iron arc, and of a few unusual spectral filters for radiation from a quartz mercury lamp.

At Corning Glass Works there has been developed a new glass, 980A, transmitting to 200 $\mu\mu$ in three mm. thicknesses. Its transmission for wave lengths of 290 $\mu\mu$, the extreme limit of the suns rays through the atmosphere, is

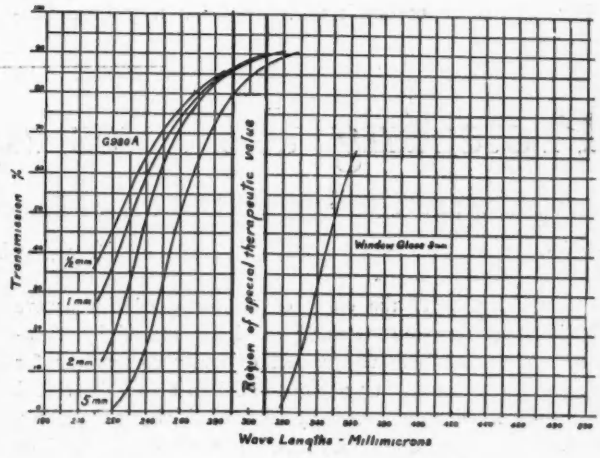

FIG. 2.
Spectral Transmission of various thickness of 890A Colorless glass as compared to ordinary Crown glass. Measurements by Bureau of Standards.

86 per cent. through a two mm. thickness (uncorrected for surface reflections) as measured by the Bureau of Standards. For purposes requiring a full transmission of ultraviolet light from the sun, therefore, this glass is practically the equal of clear fused quartz. The accompanying specto-

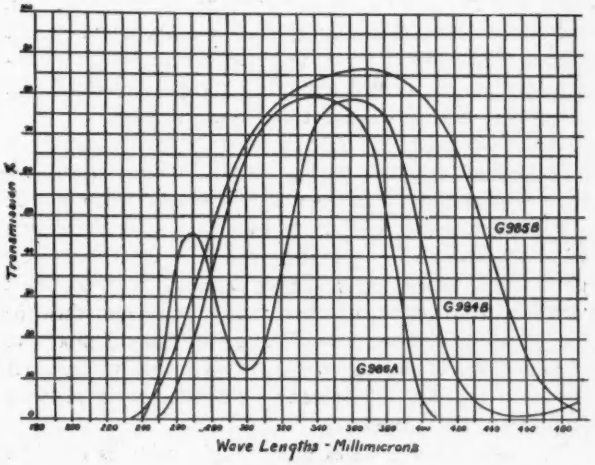

FIG. 3.
Spectral Transmission of Colored Glasses G986A, G984B, G985B. Measurements by Bureau of Standards.

grams (Fig. 1) obtained by a quartz prism spectrograph illustrate its transparency as compared with other glasses. Fig. 2 gives the transmission curves for various thicknesses of this glass as compared with ordinary window glass.

The glass may be prepared in various colors to produce

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unusual spectral filters. G985B is a blue transmitting the ultraviolet, but completely eliminating the green mercury line. G984B is green, giving a distinct absorption band in the ultraviolet. G986A is nearly opaque to visible rays, yet quite transparent in ultraviolet. The transmission values for these colors are illustrated in Fig. 3 on the preceding page.

The drop in the transmission curve in the ultraviolet for glasses and other transparent bodies is not a sharp one, but covers a region of some 80 $\mu\mu$ in sweeping from nearly full transmission down to the extreme limit of transparency. For this reason the limit of transmission may be a misleading measure of the value of a material for purposes requiring transparency. A glass transmitting to only 270 $\mu\mu$ is very apt to absorb a large portion of valuable energy in the neighborhood of 300 $\mu\mu$.

The new glass has a density of 2.64, a refractive index for the D line of 1.539, a dispersion of .009 for $N_f - N_c$, a linear expansion coefficient at nearly $O_{,}1$, and possesses a stability within the range of ordinary glasses. The cost of producing the glass is somewhat above that of window glass, but is far below that of quartz.

Several hundred plates of the glass have been manufactured and quantity production in the near future is assured.

Protecting the Eyes Against Ultraviolet Rays

Glass Manufacturer Advocates Use of Protective Glass for Making Electric Light Bulbs

By Louis Stoess*

The question of the effect of light-rays of short wave lengths on the eyes, especially the harm caused by ultraviolet rays, has been the subject of lively controversy for years. It cannot be our object to go into all of the actual causes of the dispute, especially since much personal feeling, rather than facts have played a part in the discussions. The object of this article is merely to set forth the facts, so that an absolutely objective, unbiased and scientific treatment of the subject is presented.

The ophthalmologists of course have first word in the controversy. It can be shown that in the beginning of the debate even the leading eye-specialists have denied that ultraviolet rays have a harmful effect on the eyes. It was believed that the increase in prevalence of eye troubles in industries in which the workmen are exposed to intense light (for instance the glass industry, rolling mills, foundries, the iron industry) was not due to ultraviolet rays. These opponents, however, have changed their views almost without exception, after a somewhat closer study of the facts.

Real information is furnished by experience, obtained not only in high mountain regions, especially on glaciers, but also on automobile roads built of light colored material, and also on the sea and, last but not least, during the world war, when the troops were obliged to watch large areas, causing great fatigue of the eyes, and uncertainties of vision. These troubles were especially marked during the winter, when the land was covered with snow. Through the use of protective glasses, which absorb the harmful ultraviolet rays, this evil has been removed. Testimony from soldiers is the best evidence of this assertion.

The opposing side states that sunlight, with its excellent effect on human health, contains ultraviolet rays, and yet sunlight is not avoided and is even used as much as possible during illness. However, it can hardly be said that it gives one special pleasure to look directly into the "beautiful" sunlight. Reference is made here only to the harmful effect of the direct rays on the eyes, either from the sun or from artificial light sources. When using artificial light directed to various parts of the body, the eyes are protected. It is just as important to shield the eyes against all sources of light of great intensity.

This subject becomes all the more important, since almost every day new inventions are made in the field of illumination, all of which have the object to develop a light of the greatest intensity, with which naturally is connected a higher development of ultraviolet rays.

Since it has been proven beyond doubt that ultraviolet rays are harmful to the eyes, and since due to this fact glasses have been developed which counteract these harmful influences without the slightest harm to the eyes, and without appreciable loss in light intensity, it is clear that such glasses should be used to prevent harm. No one will maintain that a sudden exposure to ultraviolet rays, as contained in sunlight or lamplight will cause trouble. But no one will deny that chronic exposure to strong light has its dangers.

Vaccination is resorted to against smallpox and typhoid, solely as a preventive measure. In a similar way the most valuable part of our body, the eye, should be protected by means that can be applied easily and without any disadvantage, and at a low cost. No one will propose the continuous wearing of eye-glasses which absorb ultraviolet rays, but in cases where it appears necessary, they can be used with great success and satisfaction. It is a simple matter to use protective glass in connection with artificial sources of light. The manufacture of electric light bulbs from such glass deserves attention, since it removes in the simplest possible manner all harm that may be caused by working in rooms lighted by strong electric lights.

The German glass industry has been first to produce protective glasses of this type. The firm of Putzler Brothers, Penzig in Silesia, manufactures such glass under the name of "Euphos Glass."

*President of Putzler Brothers Glassworks, Penzig, Silesia, Germany.

Glass manufacturers demand ground fluorspar that analyses 92% to 98% calcium fluoride, and from 1% to 4% silica.—Min. Res. 1925.

A Ten Years' Retrospect

Abstracts from the Presidential Address to the Society of Glass Technology

By Walter Butterworth

Our Society was founded November 18, 1916, at a crucial time of national emergency and it developed with great rapidity.

Out of the ferment and difficulties of the great war it emerged. At that sad time of havoc and destruction the glass industry, like many others, was called upon to undertake national services, under stress of urgent need, at shortest notice, and manufacturers had to alter their habitual methods, to meet the demands of warfare.

We had been largely dependent on foreign nations who had become enemies. The position was critical. A great effort was needed. The Government, scientists, and glass manufacturers worked together with zeal and energy, and the situation improved.

Here was the opportunity to combine forces, not only to meet a temporary crisis, but for the better organization of the national glass industry and to base it firmly upon research and applied science.

The projects of the Society were originally stated with conciseness, yet comprehensively:

> "The general advancement of the various branches of glass technology by the association of persons interested in glass and glassware, the reading and discussion of papers; the publication of scientific information on glass technology; the formation of a library and museum"

Regarding the conditions of membership a very catholic invitation was issued:

> "All persons or associations of persons interested in glass, whether from the point of view of the manufacturer, the distributor, the scientist, the user or collector, were eligible for membership."

So that people concerned in glass manufacture, directly or remotely, were invited to join forces.

The Society, through its journal, soon became the organ of the glass industry, on its scientific and technical side, and was recognized internationally as having taken a high place among scientific societies.

While research was placed in the forefront of its objects, an aim of great importance was to bring the British glass manufacturers into close co-operation and better mutual understanding than before.

The alarms and anxieties of the war time no doubt helped to draw them nearer together, in sympathetic collaboration, and incidentally contributed to the growth of the Society. Under the menacing war-cloud, business men were startled and shaken from routine; patriotism entered somewhat into trade and quickened it in certain respects. Also an ideal began to take shape among the glass manufacturers for the progress and welfare of the industry and not alone for profit. It was perceived that in business also there was room for ideals.

The Society, almost wholly British at the start, as was natural, soon gained recognition abroad, especially in the United States, and its membership now includes firms and individuals in a score of countries, wherever, in fact, the glass industry manifests vitality.

Ten years ago, the time was ripe, nay it was overdue, for the establishment of a Society of Glass Technology, in this country, and it appeared in response to the need.

We had rested too long satisfied with the antiquated system of isolated factories, outworn rules and ancient usages. The quickly changing times, the new demands, called for action and radical changes in factory methods and in trade outlook. Much was to be learned and some things had to be unlearned. It began to be recognized that secrecy and industrial isolation must give way to openness, mutual aid and co-operation.

Not all the manufacturers have fully maintained that faith in the openness and co-operation which gained ground during the war. It is a pity. If untrammeled intercourse and mutual aid were serviceable during the war, why not in peace-time? In our ancient and interesting trade there are many problems to face and by combined effort we shall surmount them better and more swiftly than by mutual suspicion or dogged conservatism.

Meantime our scientists and technologists have steadily and uninterruptedly pursued their way. They have gone on with their investigations into phenomena touching the production of glass. They have followed the light of knowledge and added to the volume of things tested and proved.

When the Society published its first quarterly there was a dearth of technical literature on glass, especially in the English language. It set about vigorously to supply this want. Year by year it has published its proceedings, its papers and discussions, with specifications of patents and abstracts of articles concerning glass in British and foreign journals. Indubitably, the publication of these scientific and technical investigations has given us, for ready reference, the most important addition to the knowledge of glass technology, in the last decade, in any country. And it has largely superseded what had been written previously. The Society also published a useful Directory of the British Glass Industry, a pioneer work and formed a reference library of over 500 volumes, dealing with glass.

We have progressed far in these ten years and we shall go much further if we persevere with better equipment through scientific research, joined with elimination of waste, better organization and concentration, and the ready adoption of improvements.

The Society with its usual alertness has recently mooted a new project and is only holding its hand until the present strike difficulties pass. The idea is to associate with a great convention in London, the organization of a fully representative glass exhibition. The two projects together, embracing every phase of glass manufacture, scientific, technological, industrial and artistic, should give an impetus to the industry.

DR. OTTO SCHOTT

Born December 17, 1851

VIRGIN

Dr. Otto Schott

By Dr. Hans Götze*

In Jena, a small University town in Germany, Dr. Otto Schott will commemorate his seventy-fifth birthday on December 17, in the full possession of his physical and mental powers and in the midst of his varied activities, a man whose name is renowned the world over in the glass and optical industry, whose labor and success has opened up new fields in the development of the glass industry and who has laid the foundations of modern optical science.

Schott comes from a family of glassmakers. In the glassworks owned by his father, who manufactured window glass, he learned the art of glass manipulation and the romance of glass manufacturing. The melting process, with its play of flames in the all-consuming glow of the furnace, captivated him to such a degree that it gave to the youth his life's aim, which he followed with a success such as is accorded to few men.

Schott gained the necessary theoretical knowledge in several universities, and received the doctor's degree in the year 1875 in Jena, conferred on him upon a thesis describing an experimental study, made in Leipzig, on the defects occurring in the manufacture of window glass. Practical experience was obtained in numerous glass works at home and abroad. Travels to Spain, England, Scotland and France gave him an exceptional view of the industrial conditions and the glass chemistry of his day and accorded to him an exceptional position in the glass world, among men of purely practical attainments. To the industrialist of his time the idea of a scientific treatment of glass, or of a systematic study of the melting process did not occur, not to speak of the requirements made on the part of the physical and chemical profession, although there had been no lack of efforts in this direction by a few isolated investigators.

Especially the optical industry, which in these years was making powerful attempts towards advancement, was suffering from lack of interest on the part of manufacturers. It is not difficult to understand the words of a man, who has had a decisive influence on the life work of Schott, the scientist Ernst Abbe of Jena, the father of modern scientific and technical optical science, who still in 1874 could say: "Every hope is excluded that the art of glass making will develop beyond its present condition, or that an independent effort will be made to meet the requirements of practical optics with regard to new kinds of glass."

At the International Exhibition of Scientific Apparatus, held in London in 1876, Ernst Abbe repeated this complaint, directed to the glass manufacturers of the whole world. Fate has decided differently. At that time already, Schott had envisaged his life's work: to carry out a general systematic study of the phenomena of melting with the object to establish the fundamental laws of a pyrochemical science, on the basis of which it would be possible to determine the reactions which take place during the melting process—the aim and object of modern glass science. Already in 1879 Schott could communicate to Abbe the first results of his researches.

The cooperative labors of both men began. Schott carried out the experimental melts, Abbe tested the optical properties of the glasses produced. The object was to study the influence of the chemical elements which could enter in any form into amorphous melting compounds, with regard to their influence on the refractive properties and dispersion. The success of these experiments soon allowed the systematic production of optical raw glass and, after Schott in the meantime had moved his home to Jena, he felt encouraged to abandon this phase of scientific experimentation and to commence the production of similar new glasses in practice on a factory scale, based on the scientific achievements. In partnership with Carl Zeiss and Roderich Zeiss the glassworks of Schott und Genossen was established. Abbe had thus created the foundation of the development of the modern optical industry. He had the glass factory as his collaborator which, working primarily only on a strictly scientific basis, could produce glasses necessary for the optical products made in the well-known Zeiss works.

With the solution of this crucial problem of optics, the efforts of Schott did not cease. His restless spirit was not satisfied with one achievement. He was, and still is, always on the alert to solve practical questions of vital importance to the application of glass.

The development of the glassworks required as a natural sequence the extension of the field of activity; the production of optical glass alone could not establish the enterprise on a paying basis. New lines of endeavor had to be laid out, requiring scientific treatment of glass. In order to bear the expense of scientific research work it was necessary to produce special glassware which was to yield a profit to the enterprise, sufficient to bear the inevitably high cost of scientific research.

The demands of science and especially the chemical industry required the production of new special glasses having definite physical properties. The thermometer glass industry of Thuringia was world famous; however, it could not maintain itself, since the glass could no longer meet the increasing demands of science and technology. Accurate temperature measurements were becoming impossible; at higher temperatures the use of these glasses became excluded on account of their tendency to soften at too low a temperature. The danger therefore existed that all experiments of scientific and technical institutions might have to be repeated in order to establish their final values on account of the uncertainty of the accuracy of measurements. The German government recognized the importance of this question and entrusted to a friend of Schott the preliminary work, leading to the foundation of a physico-technical experiment station. Schott and his friend immediately carried out the experiments necessary to attack the thermometer glass problem and succeeded in solving it.

The scientific principle of the influence of thermal changes

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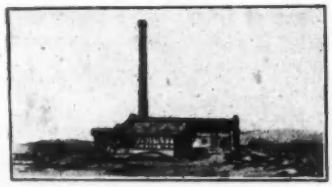
of glass was found to be the presence of both sodium and potassium silicates. It was further established that pure sodium and pure potassium glasses are practically free from thermal after-effect, and that the effect is most marked when the silicates are present in equal proportions.

The thermometer glasses made up to the present date in Jena on the basis of this law—one a sodium, another a borosilicate glass—allow temperature measurements up to 500 deg. centigrade and have found recognition and a market throughout the world. The "Jena Normal Glass" gave to the glass works of Schott und Genossen world renown.

However, this achievement was not sufficient. The chemical industry also owes much to Schott. For he succeeded in creating the Jena chemical glassware, to take the place of ordinary glass lacking in resistance against chemical reagents. He gave to the chemical industry the means to carry on its experimental work, freed from the drawbacks existing heretofore, from the faulty results which could only hinder the advancement of science and technology. Jena chemical glassware had the advantage of being able to fulfill the highest demands with regard to chemical resistance; it excels in mechanical and thermal resistivity so that it rarely breaks through sudden heating and cooling.

The outline of Schott's accomplishments would be incomplete if one were to omit his effective work in the field of

IN THE EARLY DAYS



illuminating glassware. At that time the use of illuminating glassware was in its beginning. The difficulty of producing suitable incandescent gas mantles had been overcome. Should the industry now suffer defeat on account of the glass cylinders, which always cracked on account of the sudden heating, produced by the lighting of the flame, and by the cooling after turning off the gas? Schott was its savior and benefactor. The Jena gas-light glass cylinder was created.

The never ceasing development of technology continually raises new problems for the glass industry to solve. Schott and his glassworks are indefatigable in the further development of chemistry and physics of molten glass. New glasses for new properties! Only one example: a glass which replaces mica for the purpose of wireless telegraphy, on account of its exceptional insulating powers and other properties.

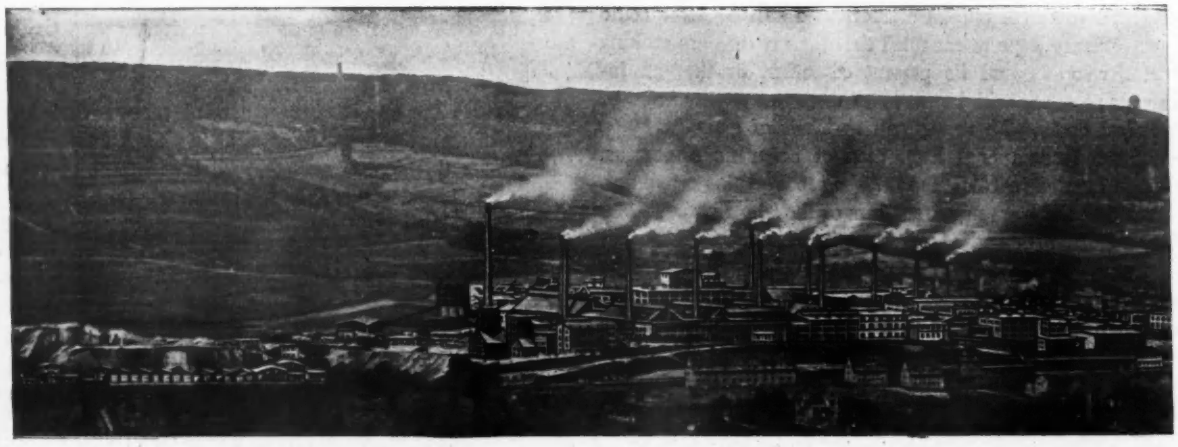
The commercial exploitation of the mental work of Schott is more than ever necessary if his glassworks is to maintain the honor of its founder's name, and to uphold its exceptional position in the glass industry. The guiding principle of all efforts is to combine science and practice, in order to insure commercial success in addition to scientific accomplishment.

From the smallest beginning, the Jena glass works have developed into a large industrial enterprise, in which 1,500 workmen and employes follow their occupation. The works are managed according to special economic principles and belong to the Carl Zeiss Foundation of Jena. Schott has crowned his life's work by sacrificing his personal financial profit in favor of his co-workers. In his glassworks, he is only the first worker.

To a man like Schott all honors have been given which science and technology can bestow. He is celebrated as a master who has learned to make glass, suitable for all uses, for optical, thermal and chemical purposes. He is the founder of glass science, the first who has left the path of pure empiricism and who with the aid of scientific research has learned the art of producing properties, needed in every case.

His works, the Jena glassworks of Schott und Genossen is being conducted on this principle and from this derives its success. The German glass industry looks with pride on the founder of modern glass technology whom the German Society of Glass Technology has made an honorary member.

The glass industry of the whole world is in honor bound to express its gratitude for the achievements of Dr. Schott, at the occasion of the celebration of his 75th birthday. May it be granted to him to enjoy a well-earned rest to garner the fruits of his life's work. And may it be granted to the world to find in the future men in the glass industry to carry on the work along the paths indicated by Schott, for the betterment of the glass industry and for the good of humanity.



THE FAMOUS GLASS WORKS OF SCHOTT UND GENOSSEN AT JENA, GERMANY.

The Gaging of Fuel Oil Storage Tanks

By E. L. Peffer*

The measurement of oil presents certain difficulties that are not present in the case of other fuels such as wood or coal. Wood may be ranked, the measurement taken, and the number of cubic feet or cords determined. For approximate results coal may be measured in the bin and the cubical contents determined, and this value multiplied by the weight per cubic foot of the particular grade in question will give a check on the delivery. For accurate results the coal may be re-weighed after delivery has been made. Oil, however, cannot be ranked, or placed in a bin so that measurements can be taken, and it is therefore necessary to rely for checking purposes upon the known capacity of the container or storage tank into which the fuel is placed. It is to be understood that the storage tank is not to be considered as a commercial measure but is a container into which oil is delivered and in which it is stored for use as required. The consumer is as much entitled to full measure and to have an opportunity to check this delivery as in the case of buying any other commodity.

I realize that on account of its many other duties and the amount of work involved in the matter under discussion, it would be impossible for the Weights and Measures Department to check all deliveries of fuel-oil by inspection or to measure all of the tanks as installed. However, one of the functions of the weights and measures official is to advise the people in his jurisdiction how to check the delivery of commodities, and I believe fuel-oil storage-tank measurements are of such importance as to merit special consideration.

The tanks that have come under my observation have been rectangular, cylindrical, oval, or a combination of the rectangular and cylindrical. The large tanks were found to be cylindrical and are usually placed in the ground outside of the building. The smaller tanks are found to be of the three other types already mentioned and are placed in the basement at some convenient place. These small tanks are in many cases supplied with a gage, the purpose of which is approximately to indicate the amount of oil in the tank, that is, full, one-half full, empty, etc. This indicator is not intended to serve as a check on the amount of fuel delivered into the tank but merely to indicate when a new supply of fuel is needed.

The total capacity of the cylindrical tank and the rectangular tank may be readily computed if the inside dimensions are known or if the tank is available for measurement after installation has been made. In the case of the tank that is buried, the measurement of the diameter and length cannot be made after installation is complete; however, the information may perhaps be obtained from the maker or firm installing the equipment.

The product of the length, breadth, and height in inches, divided by 231, equals the contents in gallons of a rectangular tank. If the tank is partially full of oil the contents may be determined by the same method, in which case the measured depth of the oil in the tank represents the "height."

The total volume of a cylindrical tank having flat ends is determined by use of the formula:

$V = 0.7854\ d^2\ L.$

Where V = volume. d = diameter. L = length.

When the inside dimensions in inches are substituted in the formula and the computations completed, the result is the contents in cubic inches; this figure, divided by 231, equals the capacity in gallons. The contents of a partially filled horizontal cylindrical tank can also be determined by the use of tables given in some of the engineering handbooks. It is probable, however, that in this case the use of a gage-stick would be more desirable, this stick having been graduated by a volumetric method.

This volumetric method, which is applicable to all of the tanks referred to, is especially to be desired in the calibration of oval tanks or tanks of other unusual shapes where the mathematical calculations become more involved. The steps in the calibration of a tank by this method would be first to prepare a gage-stick of sufficient length to reach the bottom of the tank. The stick should be painted; an unpainted stick will not show a sharp clear-cut line at the highest point reached by the oil, but one that is painted with black paint, without gloss, will show this point very well indeed. The stick can be graduated by delivering into the empty tank a known number of gallons, inserting the stick into the tank, withdrawing it, and placing a mark at the point indicated by the oil. Successive quantities of the same volume can then be added, and the other operations repeated until the tank is full. Care should be taken in the graduation and use of a gage-stick to see that the end of the stick is always at the lowest point of the tank and that it is held in a vertical position.

In some cases a gage-stick is supplied with the oil-burning equipment.

The use of a gage-stick is not recommended as a means of commercial measurement of oil delivered, but serves as a means of checking the delivery of oil so that the consumer may be assured within a reasonable degree of accuracy that the amount of oil received agrees with that for which he is requested to pay.

The question of the change in volume of oil with change of temperature has not been considered in this paper, inasmuch as the general practice is to ignore such volume changes in sales to the consumer. As an example of the size of this factor, one may say that for an oil of 28 to 32 A. P. I. the volume change resulting from a temperature change of 50° F. amounts to approximately 2 per cent. For complete data on volume changes reference may be made to Bureau of Standards Circular No. 154 with supplement.

In conclusion, let me say that weights and measures officials have an opportunity to be of service to users of fuel oil by giving timely advice as to methods of checking deliveries of the oil.

* Bureau of Standards. Abstracted from a paper presented at the Nineteenth National Conference on Weights and Measures.

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THE
GLASS INDUSTRY
Heartily Extends to Its
Readers, Authors and Advertisers
The Compliments of the Season

Dr. Otto Schott

Progress in science does not occur gradually, like the growing of a tree. It develops by leaps and bounds. Observations are made, facts accumulate, conclusions are drawn, theories are advanced and tested, but it remains for the man of genius to embrace the work of a generation to take science a step in advance, to enlarge the horizon, to give to investigators new problems to solve. There is work for those of lesser abilities when the man of genius labors. When kings build, there is work for many.

Almost every branch of science is linked indissolubly with the name of some great man, who has given the efforts of a lifetime and the fruits of his genius to advance the science to which he is devoted, a man who has laid the foundations upon which new conceptions are based, upon which new achievements are built, and whose name will live as long as science shall be the means by which mankind advances. To chemistry such a name is Lavoisier, to electricity Faraday, to bacteriology Pasteur, to botany Linnaeus, to biology Darwin, to ceramics Seger, to the glass industry and glass science it is the name of Otto Schott.

It would be difficult to overestimate the value of Schott's work. But because we are so familiar with the results, which form the very basis of our present knowledge of glass, we are prone to overlook the fact that what we consider well established and self-evident, was before Schott's time *terra incognita*.

Prior to the research work of Schott practically only two kinds of glass were known, namely the ordinary alkali-lime glass, for window, plate and hollow glass, known as crown glass, and potassium-lead glass, known as crystal or flint glass. It is true that Guinand in France and Harcourt in England made experiments with the purpose of introducing other elements into glass, in order to obtain glasses with properties different from crown and flint, but their work never developed into actual practical results and remained entirely in the experimental stage. It was the genius and persistence of Schott which was able to translate the results of the laboratory into actual glass works practice, by which he opened up a new and virgin field to the glass industry. The glasses made by Schott differed from any made before with regard to their properties, optical, mechanical, electrical, thermal and chemical. Present day developments of new glasses are based entirely on the principles laid down by his labors.

The great merit of Schott's work lies in the fact that while the practical viewpoint was never lost sight of, yet every problem was attacked from its foundation and therefore became, upon its solution, an established scientific fact, which could serve as a stepping stone for fu-ther advancement. The purely empirical method, so attractive to those who look only for the superficial and for quick results, never lured Schott away from his fixed purpose. This is a lesson which the glass industry of today is as yet slow to learn. We need such work as Schott has performed, work of a fundamental nature, rather than the patchwork for purely temporary and local purposes.

World industry and world science, fortunately, can afford to ignore the boundaries which separate nations, and which

have brought upon the human race more disaster than the combined attacks of storm, earthquake, fire, famine and pestilence: the scourge of war, which threatens civilization itself with extinction. Industrialists and scientists the world over join in homage to Otto Schott, master glassmaker, master scientist, on his 75th birthday.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility the GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions than those printed are invited to submit them. All inquiries will be considered confidential.

Methods of Designing Blank Molds

QUESTION 103. Does there exist a rational and scientific method for the design of parison molds for narrow neck bottle machines?

ANSWER: This question has been submitted to a number of manufacturers of automatic glass making machinery and other experts. Some of the replies received are given herewith.

"1. There is no scientific method of designing blank molds. The capacity of the mold is, of course, determined by the weight of the finished ware; the shape of the parison is determined by the shape of the ware, the distribution of the glass in the ware, the character of the glass and the type of machine. The last two are usually as important as the first two, and may be much more important, so that the same type parison will not give the same results with different glasses or machines.

"The distribution of metal in the mold is also of considerable importance in determining the distribution of glass in the ware, in so far as it affects the temperature variations in the parison. Mold designers all base their design on what experience has shown them to give the best results on similar ware, made under similar conditions. Whenever conditions occur which are new to them, they usually have to modify the design of the mold, sometimes several times until the best results are obtained under the new conditions.

"The function of the blank mold is to determine the distribution of the glass in the blow mold. With any definite machine and ware conditions, this distribution is determined in the main by two factors, namely the variation of viscosity throughout the parison and the cross section of the parison. The variations in viscosity are of course dependent on the character of the glass and on the variations in temperature throughout the parison. It is axiomatic that in any moving body of glass the greatest flow is always in that portion of the mass of moving glass which is the hottest and consequently the most fluid.

"As there are a number of factors which influence the distribution of the glass in the blown article, there is not necessarily one design which is the best for a definite style of ware, in fact, the design of necessity varies with machine and glass character, and it is often observed that blank molds of quite different design give equally good results, on the particular style of ware under similar glass and machine conditions."

"2. It has been our experience that designing mold equipment for making bottles by mechanical means is almost wholly a local problem. This is particularly true regarding blank molds and plungers. Composition of glass, the temperature at which it is delivered to the molds, and the speed of operation all influence the distribution of glass in the bottle, and when the condition of either composition, temperature of glass or speed of machine is changed the appearance of the bottle is likewise changed.

"Molds producing splendid results when fed by hand-gatherer seldom, if ever, do equally well when fed by mechanical feeder although composition and temperature of glass when delivered to the machine remain the same. Often in hand-gathering practice one man may produce perfect bottles and a different man, faster or slower in gathering, may do but little good. The correct shape of the blank mold has most to do with making the bottle but we consider it impossible for the most skilled mold maker to produce blank molds that can produce high quality ware with changing conditions of glass. The design of a mold is fixed by the designer; it has no reasoning power by which it may adjust itself to the changing conditions of the glass. Therefore all things working with molds and machine should be unvarying if the best results are to be obtained. Neither molds nor machine alone make bottles. They only help you to make the ware. The man responsible for your glass and the man in charge of your mold and machine department should work in co-operation. When your mold maker knows the nature and temperature of glass he may depend on, he should have little trouble in designing the proper blank molds.

"We know of mold sets being sent from one factory to another where the same type of machine was used and although the blank molds worked perfectly in their home plant, they were useless in the second factory. This not only happened in one plant but in several and with many different sets of molds. We have also seen blank molds produce perfect ware when fed by a good hand-gatherer but the same blank molds would not work when fed by a mechanical feeder in the same factory.

"We are sorry that we cannot offer something of real value in reply to your inquiry, but we are of the opinion that the making of blank molds for mechanical feeding or hand-gatherer is to a very large extent up to the local mold maker."

"3. Regarding the proper method to pursue to design parison molds for narrow neck bottle machines, will say that I do not know if there is any specific method to follow. It is a matter of cut and try until you get the proper thing and then follow out about the same method in making the next parison, which when it is all summed up, is a matter of experience or experiment, as you might call it, rather than a scientific method, in order to get the proper shape and size.

"You do not state, however, whether an Owens machine or a blow back machine is used, in which case the design of the parison mold would be entirely different. I do not think there is any mold maker that can give you any specific method to follow in designing parison molds to work with, or in connection with blow molds."

New Publications

PRODUCTION OF OPTICAL GLASS. A reprint from the proceedings of the Optical Convention of 1926 in London, England, entitled "Some Recent Developments in the Art of Production of Glass for Optical Purposes," by W. H. S. Chance, M.A., and W. M. Hampton, B.Sc., of Chance Brothers & Company, Ltd., Smethwick and Glasgow. This paper gives an account of a number of problems which arose in connection with demands from various sources for glasses having special optical properties.

From 1848 up to the outbreak of war Chance Brothers were the sole manufacturers of optical glass in the British Empire. In 1914 they were listing approximately twenty-six types. In 1918 they produced an output equal to some four or five times the estimated pre-war world demand and are now (1926) listing 112 varieties. Considerable advances have been made in the development of special types of press and aerial photographic lenses. Details are given of difficulties experienced in manufacture and how these have been overcome.

A range of glasses has been produced to replace the colored gelatine filters previously used for isolating various portions of the spectrum. The "distant" signals of British railways are being fitted with a special orange-yellow glass developed by the firm, which enables the drivers to distinguish "home" from "distant" signals and thus conduces to further safety in railroad travel.

The introduction of the company's "Crookes" glass for spectacles has to a considerable extent taken the place of the ordinary white glass previously in general use. This glass affords great relief to sufferers from eye-strain.

A roofing glass, "Calorex," which absorbs heat while transmitting light, is finding numerous uses for factory glazing in tropical countries and "Antifade" is being used in airship sheds to protect the contents from the injurious effects of ultra-violet light. The firm is manufacturing for F. E. Lamplough, M.A., a new form of window glass termed "Vitaglass" which has the property of transmitting the curative ultra-violet rays present in sunlight.

CULLET PILE PHILOSOPHY

By SILICA SAM

Good Will

The loss to the world through lack of good will is not limited to any class of people or to any station in life.

Through the habit of limiting production, some classes of labor today are cutting down the total of human wealth, and are reducing the well being of all men.

Good will toward men cannot be harmonized with limitation of reasonable production of necessary goods. The man who lays fewer bricks or sets less type than would be possible without overwork has robbed society, and no plea of unequal distribution will absolve him.

The compulsion of class feeling which would prevent a man from doing the best work he can is one of the barriers against general good will which must be broken down. The spirit of adventure and the willingness to risk are necessary wherever an advance of human welfare is sought. Whoever, in the spirit of service to society helps to overcome the habit of limiting production, in labor or in management, is making a contribution of good will toward men.

Good will demands no special privileges but shares the risks of life. When a man undertakes to get natural resources into his private possession in order to levy tribute on men who must use them he is a social parasite, and lacks that good will which brings peace on earth.

Society has not worked out adequate means for administering natural resources, and very often their private ownership and management is a form of trusteeship that benefits everyone, the profit from their operation representing wise management and not a tax on the people. But far too often there is deliberate design to control natural wealth so that men of privilege may reap where they have not sowed. Blessed is that man whose own heart tells him truly that he is a trustee and not a parasite.

Will is that which turns desire and feeling into decision and conduct. Good will to men is that attitude toward life which turns good feeling into appropriate living.

Patience

The willingness to wait with patience, to let time and the law of averages work for you, is a distinguishing quality of great men.

The distinguishing quality of great scientists is patience. The insurance business is a monument to what compound interest will do if favored by time and patience. The patience of trout fishers is classic. Noted detectives are marked for patience—for their willingness to collect evidence bit by bit until they have a chain which cannot be broken.

There is such a thing as alert patience—godly patience and on the other hand, bovine patience or satanic patience.

City life makes men too impatient, to their misfortune. A delay in an expected promotion or an increase in salary causes them to sacrifice three or four years of effort.

Farmer boys, come along lacking the ability and agility of city boys, but endowed with generous patience. They don't expect to pick fruit the first year. They hang on, and on, and when a melon is cut they get their slice.

Industrial Relations

Our industrial organism must be greatly modified if social welfare is to be stabilized, but there is small chance for any of us to contribute to an understanding of economic well being except as we ourselves realize the long slow process by which it has developed, and have learned to exercise the responsibility, restraint and good will which make it possible.

A poor workman quarrels with his tools, and a poor leader with his followers. Two fundamental requirements of leadership are the capacity to lead and identity of interest with those being led.

The usual reason why the laborer is a laborer and not a manager is that he lacks capacity for management. The man with capacity for management seldom remains long a laborer. Sometimes he becomes a manager in industry, sometimes a professional labor leader.

If capital and management will actually, in heart and in head, share their lot with labor, then labor in the long run will recognize that leadership and will be loyal to it. Otherwise labor will continue to seek leadership of its own—leadership which in some cases may undertake to poison the mind of labor against those whose interests are in fact nearest its own.

When the minds of the nation's workers become embittered, it is most difficult for a single employer to develop loyalty in his own ranks. Therefore industrial relations are our common concern.

Continuing peace in industry can come only as capital and management really identify their interests with those of labor, sharing its burdens, risks, and aspirations, and make that identity of interest plain beyond reasonable doubt.

Quantity production furnishes stimulating interest to the directing minds, but to routine workers it often means deadening repetition. Americans should not become content with that repetition. Normal spirits can grow only in normal environments. The unintelligent bitterness of spirit which is slowly spreading through American working classes is a not unnatural result of a life of mechanical repetition, unrelieved by interests which lend color and flavor.

American labor does not need primarily more wages; it needs more living, so that its wages shall buy well-being, and not simply merchandise. We need a new code in advertising and in business which will influence people to refrain from buying goods that will not genuinely increase their well being. Such a code would demand revolutionary changes in prevailing tastes and habits—a new social outlook.

Good citizenship will work for such a change. Habits of thrift and of simplicity in living would reduce the time required at drudgery in industry, and would release energies for larger living and more normal spirits.

Industry exists to increase human welfare and when it fails of that purpose it becomes a public evil to be recognized and mastered as any other. It, as our own handiwork, has no proper immunity from critical examination.

Taxes

Theoretically, the perfect tax would be a tax on inaction.

The proper man to tax would be the loafer, not the worker; idle land, not used land; inactive capital, not active capital; lack of enterprise, not enterprise.

Such a tax would not be practical, but it would be a just tax.

Our present taxes are based on an opposite theory.

We tax thrift, action, capital, enterprise.

We levy taxes in proportion to ability to pay, which means that the harder a man works the more we tax him; the more thrifty he becomes, the more we soak him; the more efficient he grows, the more we shake him down.

If I save my money and buy a house, I am taxed; if I waste my money in extravagant living, I am not taxed.

None of our taxes are designed to encourage production by the simple process of discouraging idleness, shiftlessness and inefficiency.

The devil himself could not do a better job of hobbling the human race.

Soft jobs come to those who have done hard jobs well, and easy money is postponed payment that comes to the man who has earned hard money.

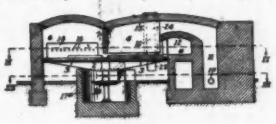
The way a family's necessities just equal the breadwinner's income is an inexplicable mystery.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

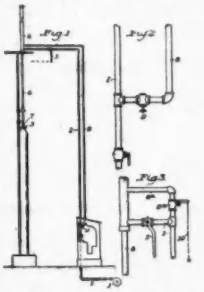
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

METHOD AND APPARATUS FOR FLATTENING SHEET GLASS. U S. 1,604,823. Oct. 26, 1926. John Hartzell, Arnold, Pa., assignor to Window Glass Machine Company. Filed 10/17/24. Apparatus for flattening glass comprising a chamber, a flattening wheel within the chamber, a division wall extending into proximity with the wheel to form a smaller chamber adjacent which only a portion of the wheel may reside at any one time, means for specially applying cooling fluid to such smaller chamber, and means for regulating the quantity of cooling fluid supplied.



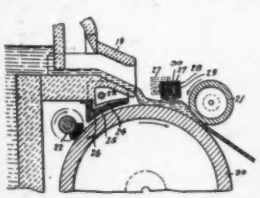
GLASS-MOLDING MACHINE. U. S. 1,605,797. Nov. 2, 1926. Andrew H. Tyson, Washington, D. C. Filed 7/20/25. The feed mechanism conveys the flowing molten stream of glass from the supply tank source to the various molds of the machines to which such feed-spouts may be adapted, and comprises a rotary trough for continuing the flow of molten material to the molds, instead of moving the molds and necessary accompanying heavy machinery to the supply, as heretofore.

AIR-SUPPLY SYSTEM FOR GLASS-DRAWING MACHINES AND PROCESS. U. S. 1,604,781. Oct. 26, 1926. Louis G. Neurohr, New Kensington, Pa., assignor to Window Glass Machine Company. Filed 12/2/22. This invention provides means for supplying air at suitable pressure during cap-forming without regulating the vent opening, thereby eliminating the vent closing mechanism with its attendant disadvantages. By this invention there is provided a plurality of air conduits arranged to supply air at different pressures. A graduating valve may be provided in one conduit to secure an increasing air supply during the drawing of the cylinder proper while another may be free and unrestricted, as opposed to the throttling action of the graduating valve, and arranged to supply the air during cap-forming.



MEANS FOR FORMING CHARGES OF MOLTEN GLASS. U. S., 1,603,160. Oct. 12, 1926. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 6/1/20. The spout is reciprocated vertically. The upward movement of the spout tends to accelerate the movement of glass therethrough, while its downward movement tends to retard the flow. In combination with the spout, the inventor preferably employs a mechanical regulator in the form of a stationary plug extending vertically downward through the glass into the spout. This regulator restricts the outlet opening and opposes any tendency of the glass to be carried upward with the spout as the latter rises.

METHOD OF AND APPARATUS FOR FORMING SHEET GLASS. U. S. 1,605,736. Nov. 2, 1926. George E. Howard, Butler, Pa., assignor to Hartford-Empire Company. Filed 2/2/26. One object of the invention is to provide a means and a method whereby glass may be supplied to sheet-forming rolls in the form of streams having considerable depth relative to the thickness of the finished sheet, in such manner that the molten glass is distributed across the face of the sheet-forming rolls with a minimum relative displacement of the glass particles, and wherein there is a minimum variation in decrease of temperature as between various portions of the glass so distributed, and diminishing the opportunities for the formation of ream.

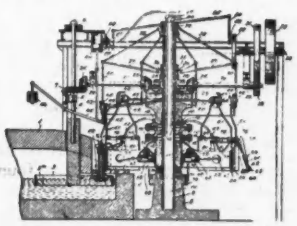


METHOD OF MANUFACTURING DECORATIVE GLASSWARE. U. S. 1,604,557. Oct. 26, 1926. Paul W. Jenkins, Charleroi, Pa., assignor to Macbeth-Evans Glass Company. Filed 9/10/24. The practice followed for many decades in the manufacture of decorated glassware of the character illustrated has been first to form, usually by blowing, glass articles having plain surfaces, then to form, by the etching process, relief designs on such areas of the glass as it was desired to have decorated with coated relief designs, and finally to coat the so-called relief design areas, usually with a suitable paint. By far the largest item of expense is incident to the etching process. The object of this invention is to provide a method of manufacturing such glassware, whereby it may be produced at a greatly reduced cost, a method which does not weaken the glassware, and a method which may be used to form relief designs which are either flush with or project beyond the undecorated surfaces of glassware. A mass of plastic glass is placed in a mold having an area of its surface provided with a relief design, and pressure is applied to the mass to simultaneously shape the article and to form a coating-retaining relief design on an area of its outer surface. Later an adhering coating is formed on the relief area of the article.

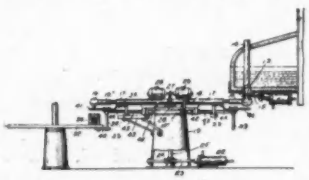
The inventor states that it has been found that decorated tumblers of the type illustrated may be manufactured according to this method at a cost less than one-fifth of that incident to the method of manufacture which has been followed for decades, that they have the same appearance as those made according to the old method, and that the coating adheres to the relief area firmly.

APPARATUS FOR MARKING GLASS ARTICLES. U. S. 1,604,152. Oct. 26, 1926. Theodore B. Drescher, Rochester, N. Y., assignor to Bausch & Lomb Optical Company. Filed 2/27/22. The identifying mark is formed upon the surface of the glass, by abrading its surface so slightly that said mark will become visible only upon the application of a finely divided material, such as by a thin film of condensed moisture formed by breathing upon it, but such mark will not under ordinary circumstances interfere with perfect vision or be seen by looking through the lens. The apparatus comprises a support for the article, a rotary polishing pad, a thin protecting stencil member having an aperture interposed between the pad and article, and means for relatively moving the lens, pad and stencil to cause portions of the article to be abraded through the apertures in the stencil, and means for automatically removing the stencil from the article when the pad is out of contact with the stencil.

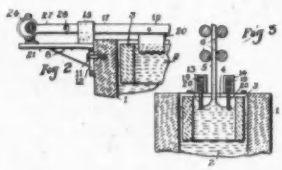
GLASS MOLDING MACHINE. U. S. 1,607,078. Nov. 16, 1926. Harry J. Hays, Washington, D. C., assignor to Reeve Hoover, trustee. Filed 3/1/24. A mold for molding sheets or plates, comprising a back plate and a front plate, said plates being spaced apart to form a mold cavity, suction means associated with the mold plates for drawing molten glass into the cavity between the plates, means for moving and maintaining the plates apart to a greater extent than the thickness of the finished sheet or plate to permit the ready entry of the glass into the mold cavity during the charging operation, means for moving the plates together after the charging of the mold cavity to compress the glass between the plates to completely fill the mold cavity, and means to move the plates apart to discharge the finished sheet or plate from the mold.



METHOD OF AND APPARATUS FOR DELIVERING MASSES OF GLASS FROM A FURNACE TO A MOLD. U. S. 1,599,790. Sept. 14, 1926. Carl H. Rankin, Wellsburg, W. Va., assignor by Mesne Assignments, of one-fourth to Charles J. P. Pratt, London, England. Filed 9/11/20. The method of delivering a charge of molten glass from a furnace to a continuously moving mold, which consists in delivering a stream of glass from the furnace, accumulating the glass so delivered into a ball-like mass, moving the mass to a charge-delivery position over a mold, and continuing the motion of the mass so as to maintain the mass over a moving mold while the mass of glass forms into a depending globule, and in severing the globule from the mass as it moves with the mold.

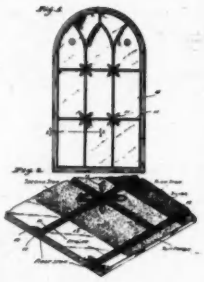


APPARATUS FOR MANUFACTURING GLASS. U. S. 1,606,298. Nov. 9, 1926. Leon J. Houze, Sr., Point Marion, Pa. Apparatus for producing drawn sheet glass entirely free of the usual discernible lines, comprising a pair of spaced horizontally disposed agitators adapted to extend into a bath of molten glass, supporting elements for said pair of agitators, said pair of agitators being arranged parallel with respect to each other and shiftably mounted in said supporting elements, means operable for imparting a reciprocal movement to said pair of agitators for agitating said bath of molten glass, the travel of one of said pair of agitators being in a direction opposite relatively to the travel of the other of said pair of agitators.



MAKING SHEET GLASS. U. S. 1,606,750. Nov. 16, 1926. Henry F. Clark, Toledo, O., assignor to Window Glass Machine Co. Filed 8/23/24. Apparatus for making sheet glass.

MIRROR AND PROCESS OF MAKING IT. U. S. 1,604,459. Oct. 26, 1926. Robert E. Lyons, Bloomington, Ind., assignor to the Nurre Mirror Plate Co. Filed 3/31/26. This invention relates to the decorating of mirrors, by the application of a suitable color-film to the rear face of the mirror in a desired pattern, usually in etched depressions, and to the depositing of a mirror-metal, such as silver, over the rear surface of the mirror, both on the glass itself where it is exposed and on the color-film where that covers the glass; and to do this when the color-film is of non-metal nature, such as a nitro-cellulose lacquer suitably colored, as by aniline dye.



SHEET-GLASS-DRAWING APPARATUS. U. S. 1,606,409. Nov. 9, 1926. Arthur E. Fowle, assignor to Libbey-Owens Sheet Glass Co. Filed 4/20/23. An improved process and apparatus for controlling the temperature of the surface glass in the receptacle from which the sheet is drawn. A protecting shield is placed over this portion of the surface glass, and an electric heating means is suspended from the lower surface of this shield closely above the surface glass to supply the heat formerly provided by burners.

Glass Factory Equipment and Supplies

Most of the information printed in this department comes direct from the manufacturers of the products described.

New Noiseless Steam Blower for Gas Producers

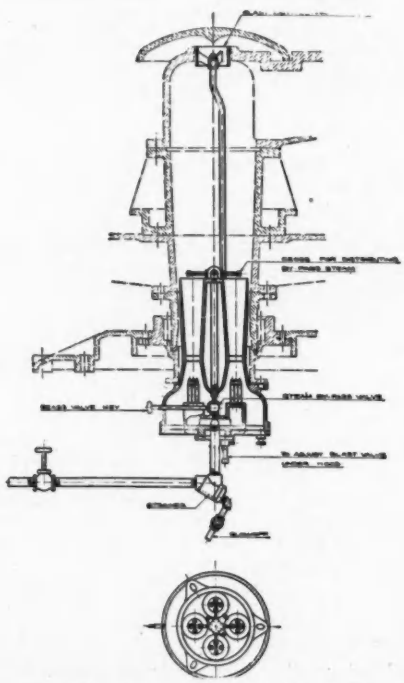
A new blower without moving parts and "noiseless" in operation has been brought out by the Morgan Construction Company, Worcester, Mass.

It is based on the new principle discovered during experimentation that when steam is discharged through a number of very small orifices direct into a Venturi tube, without the use of gathering cones, these small streams propel twice the volume of air which can be propelled by the same amount of steam against the highest resistance in a gas producer by means of a single steam jet blower of the Koerting type, and, it is stated, does this efficient work in comparative silence.

By these means the simplicity of the jet blower is retained while its objectionable features, namely noise and inefficiency are overcome. There being no moving parts the cost of both installation and maintenance are much less than with the turbine blower.

Normally this new type does not use as much steam to inject the air as is required to make good gas. The balance is supplied through a bypass pipe to a cross at the top of the blower which distributes the excess steam necessary to keep the fire at the best gas-making temperature. This bypass is controlled by a brass key shown on the left of the cut which is made separate, to be held by the gas foreman so as to prevent irresponsible tampering with the adjustment. By these means the minimum quantity of steam is used because the amount is not governed by the needs of the blower. Steam equal to 20 per cent of the weight of coal is found sufficient to gasify high grade coals although this ratio increases with the fusibility of the ash.

This new blower is specially designed for use with Morgan producer-gas machines and means are incorporated with it for controlling the amount of blast which can be discharged at the center of the fire, consisting of a valve under the hood at the top of blast arms. When this valve is closed all the air is compelled to pass through the hollow arms of the producer-gas machine into the large blast ring which supports the brick lining, but if the fire tends to run cool in the center a small opening of the valve corrects that tendency. It is locked permanently in position once the proper



NEW NOISELESS STEAM BLOWER

adjustment is made to suit the coal. The air inlet plate is also permanently locked in the full open position, needing no adjustment. It is provided only to prevent ingress of air when the producer is shut down.

The maximum capacity of the producer-gas machine is reached with a steam pressure on these new blowers of only 30 to 40 lbs. per square inch unless there is unusual resistance due to high gas pressure, when 50 lbs. might be required.

The manufacturers state that the noiseless blower is now supplied as standard equipment on new Morgan producer-gas machines without extra cost and can be easily installed at nominal expense on all such machines manufactured by them since 1913. Eighty-eight of them have already been installed.

Swindell Brothers Install Tank and Machinery

Early in the summer of the present year contracts were placed with the Amsler-Morton Company, Lynch Machinery Company and Bethel Engineering Company for the installation of modern glass making equipment, by Swindell Brothers, of Baltimore, Md., who specialize in the manufacture of prescription, patent and proprietary bottles, perfumery, toilet and stoppered ware, vials, etc., and a new 20-ton continuous glass melting tank of the latest type, equipped with Lynch bottle forming machines and Bethel feeders, was placed in successful operation under the supervision of W. B. Swindell, Jr., assisted by Ross Wilson, formerly connected with Turner Bros. Co. Glass of very high quality was achieved during the first few days of operation, the percentage of ware packed increasing daily under the guidance of Mr. Wilson until normal production was reached four days after starting—a very unusual performance in the transition from hand to machine operation.

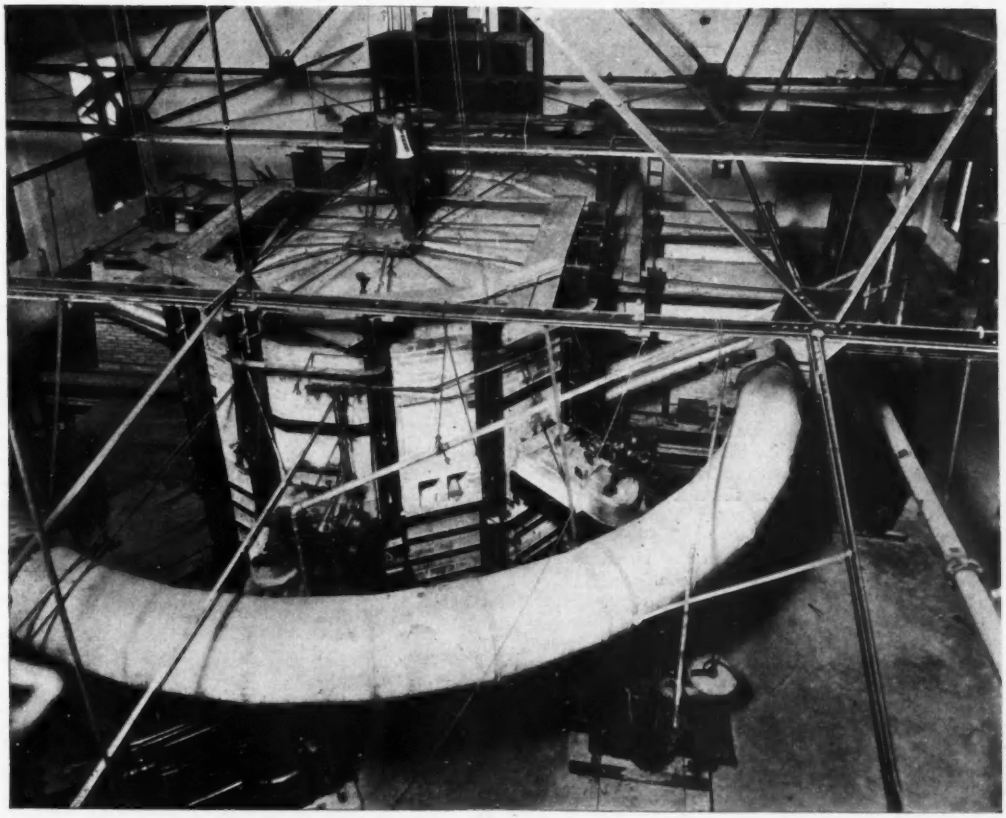
The general contract for all appurtenances, tank, alteration to gas producer equipment, fuel oil accessories, air compressors and lehrs was in the hands of the Amsler-Morton Compay. The Lynch machines, with the Odom attachment, are fed by Bethel feeders. This is a device of extreme simplicity and the operators, skilled and experienced, credit it with a very successful performance at the Swindell factory.

Power to operate the Lynch machines is derived from Worthington feather valve air compressors with spare motor-driven units to assure continuous production.

Fuel for the melting tank is supplied by one gas producer using West Virginia egg coal. Batch is fed mechanically to the tank by means of the conventional elevator and storage bin.

The glass melting tank is the culmination of ideas derived from continuous development of their High Duty tank by Amsler-Morton engineers. It is designed with very deep regenerators, short uptakes, wide ports, the tongue or horizontal partition between air and gas is eliminated, and complete insulation of the heat exchanger body and ports to the glass metal line is effected.

The regenerator walls and crown are insulated with the Armstrong Cork and Insulation Company's "Nonpareil" brick while the ports constructed of silica brick are insulated with a calcined brick effecting, it is claimed, very satisfactory results, in economy and comfort afforded the unit operatives.



NEW TWENTY-TON TANK AND EQUIPMENT AT THE PLANT OF SWINDELL BROS., BALTIMORE, MD.

Use of Duraluminum in Glass Working Machinery

Some glass working machines built by William J. Miller, Inc., Swissvale, Pa., for the Hocking Glass Company, Lancaster, Ohio, are equipped with special duraluminum castings which take the place of iron for the geneva and table castings. The weight of the machine is decreased and the manufacturing speed increased. The builders state that whenever a customer is willing to pay an increased price for his machines the duraluminum castings may be utilized and that their use results in appreciably increased production because of faster operation of the machine.

The Glass World and What It Is Doing

News of the Industry

Celebrate Prominent Mold Manufacturers' Anniversary

It is unusual for a man to be honored by the presence of his eighty-five-year-old mother at a celebration by his associates of the twenty-fifth anniversary of his entrance into his chosen field of business, but such was the experience of Chester P. Overmyer, a pioneer in the mold-making business, now president of the Overmyer Mould Company, Winchester, Ind., on the evening of October 28. His mother, with her daughter and son-in-law, had driven some fifty miles to be present.

Others attending the surprise banquet tendered that evening to Mr. Overmyer were local business men of Winchester, glass factory executives from several bottle factories and the officers, department heads and foremen of the Overmyer Mould Company. Among them were Albert Myer of Glenshaw Glass Company, Glenshaw, Pa.; Mr. Bauman of Macbeth-Evans Glass Company, Marion, Ind.; Luther Kimmel and Russell McHatten of Woodbury Glass Company.

After the banquet the Rev. P. E. Greenwalt gave an address on "C. P. Overmyer Outside of the Factory," which showed that the subject of his remarks was interested in other things besides his factory, which tended towards the good of his community. Numerous letters were read by Morton Longnecker, secretary and treasurer of the company, from executives of the bottle industries all over the United States. These letters were high in the praise of the business ability of Mr. Overmyer and his organization.

William M. Elkins, vice-president of the company, acted as chairman and called upon several of the glass manufacturers and fellow townsmen for short talks, after which Mr. Overmyer in a few words thanked his organization, the business men of Winchester and the glass factories all over the country for their cooperation in helping to build up the company, and modestly endeavored to make it clear that its success was not and could not be dependent on himself alone and that its quick growth was due to the fine spirit of the organization which he guided.

Mr. Overmyer's mother was called upon to make a few remarks and fearing perhaps that an excess of compliments such as he had been hearing all evening might be enough to turn any man's head, seemed to consider it advisable to apply an antidote and told of some of his boyhood escapades, to the great amusement of those present.

Mr. Overmyer started to learn his trade on October 28, 1901, as an apprenticed mold maker. After serving his apprenticeship he worked several years for different concerns, finally going to Pennsylvania where he took charge of a mold shop and in 1916 located in Winchester, Ind., as mold shop foreman for the Woodbury Glass Company. In 1917 the first Lynch machine was put in the Woodbury Glass Company to try out and immediately Overmyer saw the advisability of starting a mold shop to specialize in the making of molds for that machine. In November, 1920, in company with two other workmen from the Woodbury Glass Company, they started a shop in a frame building to manufacture molds. The first few months during the trying times of that year orders were very scarce but by their persistent efforts, gradually hiring additional men, buying new equipment, building additional buildings, they continued to build up the business, until today they employ ninety-seven people in the manufacture of molds, which are shipped to all parts of the world.

German Organization Sues Owens Bottle Company

The Europaischer Verband Der Flashenfabriken, a corporation of Germany, is reported to have filed a suit in the United States District Court against the Owens Bottle Company, Toledo Glass Company, Hazel O. Beesch, James C. Blair and John H. McNerney, as administrators of the estate of the late M. J. Owens; Charles J. Wilcox, James C. Blair and Charles A. Schmettau, as executors of the estate of the late E. D. Libbey; the European Owens Bottle Machine Company and the Libbey-Owens Sheet Glass Company, which relates to patents on glass-making machinery. The plaintiff alleges breach of contract and asks for an injunction to stop the defendants entering into competition with the German company in territory to which it alleged it is entitled under a contract made with the defendants. An accounting for damages and losses suffered by reason of the alleged breach of contract and an order to compel the defendant companies to transfer and assign to the plaintiff all patents and other rights for the territory covered by the contract is asked for. This territory includes all countries in the world except United States, Hawaii, Porto Rico, the Philippines, Canada, China, Manchuria, Japan and Korea.

The suit, according to the Toledo *Blade*, grows out of a contract alleged to have been signed by the Toledo Glass Company and Messrs. Owens and Libbey on November 29, 1907, in Berlin, Germany.

During the war, the petition states, it was arranged by and between the Toledo Glass Company, Owens Bottle Machine Company and Owens Bottle Company, that the last named should and it thenceforth and thereafter did, take title in its own name to all inventions made in the development department of the Owens group which had theretofore been jointly conducted. It is now claimed that it ceased to remit the inventions to the Toledo Glass Company, as provided for in the contract.

Motor Prices Reduced by General Electric

A reduction in prices on its general purpose motors, amounting to five per cent on most lines and ten per cent on commonly used sizes of squirrel cage induction motors, has been announced by the General Electric Company, effective December 1, 1926.

The motors affected by the new price levels include both a-c. and d-c., constant and variable speed general purpose motors, from one to 200 horsepower.

Prices of standard squirrel cage induction motors have now been brought by the company to a level within about 10 per cent of that in 1914.

Coincident with this reduction in prices, the company has announced a unified schedule of discounts for different classes of purchasers. The discount for quantity purchased at one time, on one firm order, has been made uniform on a sliding schedule for all classes of buyers.

These reductions have been made possible by improved manufacturing processes and quantity production, the company stated in announcing the new prices.

Prices of "B" Quality Flat Window Glass Advanced

An unexpected advance in the price of "B" quality, double strength glass, averaging 8½ per cent was announced by the American Window Glass Company as effective beginning October 25. The announcement gives the following quotations and conditions:

	A Quality	B Quality
SINGLE STRENGTH		
25″ bracket sizes	87%	88 & 3%
34″ & 40″ bracket sizes	85%	86 & 3%
50″ bracket and above	83%	84 & 3%
DOUBLE STRENGTH		
Up to 54″ bracket inclusive	84 & 2½%	87 & 5%
60″ bracket and above	84 & 2½%	86%

"The foregoing discounts are from October 15, 1912, list, f.o.b. factory. Freight will be equalized with Pittsburgh, Columbus, Kansas or such other points as we may deem necessary. Orders and specifications to be subject to our approval. Shipments to be mutually arranged.

"We guarantee the above prices for any of the above zones, except for the district including Greater New York and within 25 miles thereof, against our own declines up to date of shipment, on orders accepted by us for shipment into that particular zone.

"All other conditions, namely, boxing charges and fractional cutting charges remain unchanged.

"Prices for 'Off Quality' glass on application."

A schedule of new prices has also been issued by the Libbey-Owens Sheet Glass Company, Toledo, Ohio.

Organize Allegheny Shippers' Board

The Allegheny Shippers Advisory Board, composed of representatives of railroads, manufacturing, merchandising and other organizations that make extensive use of the railroads and the thirteenth body of its kind in the country, was organized at Pittsburgh early in November. The idea of the National Advisory Board originated during a great scarcity of freight cars for handling the wheat crops from the northwest. Its object is to foretell the needs of shippers in advance so that the railroads can provide for their requirements. The first twelve boards have met with marked success, their efforts resulting in the saving of millions of dollars to shippers by the elimination of demurrage charges, spoilage, etc. General W. W. Atterbury, president of the Pennsylvania Railroad, who addressed the meeting, stated that no other district in the United States has either the magnitude or the complexity of shipping problems that confront railroads and shippers in the district the Allegheny board covers.

The next meeting of the board is scheduled for December 13 when the shipping needs for the first quarter of 1927 will be taken up.

Among those elected to office in the new organization are J. M. Belleville of the Pittsburgh Plate Glass Company, who is vice-chairman of the board, and Royal E. Cooke of the H. J. Heinze Company, who is general secretary. A. B. Dickman, assistant treasurer of the American Plate Glass Corporation, has been made chairman of the Glass and Glass Products Committee of the board.

Butterworth Bros., Ltd., Entertain Visitors

During a celebration of "Civic Week," October 2 to 9, by the city of Manchester, England, a number of the city's prominent manufacturing plants were opened to public inspection, the glassworks of Butterworth Bros. Ltd., at Newton Heath, being one of them. An unexpectedly large number of visitors were received at this factory, over 1,000 applications for permits having been sent in.

A new showroom was opened during the Civic Week and a special exhibition was made of industrial glass, including many varieties of the firm's special high pressure gauge glasses. Butterworth Bros. Ltd., are the proprietors of the famous "Bull Dog," "Tenax" and "Invincible" brands of steam gauge glasses, and also manufacture red and white enamelled qualities.

On the afternoon of October 18, the Lord Mayor and Lady Mayoress of Manchester together with Major D. Halstead, and a number of other personal friends of the managing director, Mr. Walter Butterworth, visited the works. The sights included the founding of glass in high temperature furnaces, the manipulation of the molten glass, including the making of different kinds of tubing and of pressed and hand-made tableware, and the decoration of glass by means of cutting and engraving.

The Lord Mayor, speaking to the assembled workpeople at the close of his visit, said how extremely interesting the visit had been. He had known of the works for very many years, but had previously had no conception of the remarkable nature of glass manufacture. He had been astonished how beautiful the workmanship was, and at the large number of different processes through which glass passed in the making. He felt that it must be a joy to the workers to produce articles of such high artistic value and craftsmanship, which afterwards came to be appreciated and valued in all parts of the globe. He knew that they would be proud of the position to which their managing director, Mr. Butterworth, had recently been elected, that of President of the International Society of Glass Technology.

Libbey-Owens Dividends and Earnings

The Libbey-Owens Sheet Glass Company on October 29 declared quarterly dividends of 1¾ per cent on the outstanding preferred stock and 50 cents per share on the outstanding common stock and an extra dividend of $1.00 per share on the common stock.

At the end of its fiscal year, September 30, 1926, the books showed manufacturing profit and royalties, after deducting materials, fuel, labor, manufacturing expenses, and depreciation, of $3,997,055 and other income of $586,672, a total of $4,583,728. General, administrative and selling expense and other deductions, and development, experimental, patent and foreign expense of $558,538, and provision for fderal taxes and contingencies, deducted from total income left $610,000 for net profit to surplus.

The company's balance sheet showed on September 30, assets of $20,628,051, and liabilities of equal amount including $12,999,750 capital and $6,073,978 surplus.

Owens Bottle Earnings

Owens Bottle Co. and subsidiaries report for nine months ended September 30, 1926, net profit of $4,889,270 after expenses and federal taxes, equivalent after 7% preferred dividend requirements, to $6.43 a share (par $25) earned on 694,098 shares of common stock. This compares with $4,253,537 or $5.79 a share on 660,510 shares outstanding in first nine months of 1925.

President W. H. Boshart, in addressing a meeting of the company's 400 salesmen from all parts of the country, recently stated that in spite of keener competition, the company is now enjoying its greatest sales year.

Mirror Manufacturers and Glass Distributers to Meet

The annual meeting of the Mirror Manufacturers Association and the National Glass Distributors Association will be held on Tuesday and Wednesday, December 7 and 8, at the William Penn Hotel, Pittsburgh. The Mirror Manufacturers Association will meet in the rooms of the secretary, Harry C. Sorden, at 11:00 a. m., Tuesday, for conference after which there will be a luncheon with representatives of the Plate Glass Manufacturers of America. At 7 o'clock on Tuesday evening, the Mirror Manufacturers Association and the National Glass Distributors Association will be the guests at dinner of the American Window Glass Company. On Wednesday the National Glass Distributors will hold an open meeting, which the Mirror Manufacturers are invited to attend.

Plate Glass Production in October

The production of polished plate glass in the United States for the month of October, 1926, according to P. A. Hughes, secretary of the Plate Glass Manufacturers of America, was 11,185,713 square feet, as compared with a production of 10,713,650 square feet for October, 1925. This makes the total production for the year up to the end of October, 111,808,190 square feet.

Freight Rates on Cut Glassware Reduced

The American Association of Flint and Lime Glass Manufacturers has announced through B. E. Factor, secretary of the traffic committee, that the Consolidated Classification Committee has approved new and lower rates for cut glassware effective early in 1927. The glass manufacturers' application presented to the Consolidated Classification Committee early in 1926 was a request for a first class L. C. L. rating and third class C. L. rating, minimum weight 20,000 pounds, applicable throughout the entire country.

At the annual meeting of the West Virginia Manufacturers' Association, D. M. Weir was re-elected president, and the following elected vice-presidents: J. C. Brady, chairman of the board, Hazel-Atlas Glass Company, Wheeling; R. T. Cunningham, Fairmont; J. H. Randolph, Parkersburg; M. T. Davis, Jr., Charleston, and O. T. Frick, Huntington. J. Guy Pritchard of Fairmont was elected secretary.

Among the plants reported to have recently resumed operations are: Seneca Glass Company, Morgantown, W. Va.; Quertinmont Glass Company, Fairchance, Pa.; Pennsylvania Wire Glass Company, Dunbar, Pa.; Western Glass Company's plant at Shirley, Ind. Among the plants in which it is reported that operations will be resumed in the near future are: D. C. Jenkins Glass Company, Kokomo, Ind.; Belmont Tumbler Company, Bellaire, O.

The annual exhibition of the Associated Glass and Pottery Manufacturers will be held at the Ft. Pitt Hotel, Pittsburgh, in January, with an overflow exhibit at the William Penn Hotel.

Trade Activities

The Bison Plate and Window Glass Corporation, according to a report from Buffalo, N. Y., has reduced its capital stock from $100,000 to $10,000.

The City Glass Company, 11405 Shoemaker street, Detroit, Mich., has been incorporated with a capital of $150,000 to manufacture and deal in glass.

The main building of the **Teachout Sash, Door and Glass Company's** plant at Columbus, O., caught fire on November 6 which resulted in an estimated loss of $300,000.

The Triplex Safety Glass Company, Hoboken, N. J., manufacturers of an 'unshatterable" glass, has opened an office at 2-244 General Motors Building, Detroit, Mich., in charge of George H. Hunt.

Maryland Glass Company, Cumberland, Md., it is reported, contemplates the erection of a one-story factory, 80 by 150 feet, early in the spring of 1927, to replace one recently destroyed by fire.

The Roessler & Hasslacher Chemical Company, New York, recently announced that Theodore Lenchner, of Pittsburgh, has joined the organization, and will represent the company in the Pittsburgh territory.

The Amsler-Morton Company, Fulton Building, Pittsburgh, Pa., glasshouse engineers, announce that Robert Allen, 4437 Gainesborough avenue, Hollywood, Cal., is now representing them on the Pacific coast.

Fame Glass Company is the name under which Reeves Long, glass manufacturer of Vineland, N. J., is operating his new plant located at Second and Grape streets, that city. The company manufactures glass chemical supplies.

A warehouse of the **Co-operative Window Glass Company,** Fort Smith, Ark., was recently destroyed by fire with an estimated loss of about $35,000. It is reported that the building will be replaced by one 70 x 120 feet, of steel and concrete construction.

Queen City Glass Company, organized early this year and whose factory at Cumberland, Md., was destroyed by fire two months after beginning operations, filed a petition in October for the dissolution of the corporation, the organizers of which were local and Weston, W. Va., men.

The Interstate Window Glass Company's factory No. 1 at Kane, Pa., went into blast on November 6. Since its shutdown several months ago this plant has been enlarged and improved and at this time, according to Frank J. Andrews, general superintendent of the company's factories, has the largest eight-machine tank in the United States.

C. A. Borchert Company, which will specialize in the cutting and decorating of glassware to be furnished by the Louie Glass Company, is erecting a building on property adjoining the latter's factory at Weston, W. Va. It is expected that the plant which will be equipped with new and improved machinery will be ready for operation early in 1927.

The Hartford Glass Products Company, Hartford City, Ind., has been incorporated with a capital of $100,000, by Charles, George and Clyde Overmyer, all of Hartford City; Jack Cathers, Kirkwood, Mo., and Frank Butler, Mt. Vernon, Ohio. The company will manufacture articles of glass and metal construction, including "Glasglides" for furniture. They will make all their own stampings and assemble the products, but will not at this time establish a glass-making department of their own.

Turner Brothers Company have awarded a contract for an office building at their plant in Terre Haute, Ind. It is said that the improvement will cost about $30,000. The building will approximate 44 x 100 feet in size, be constructed of brick and concrete, trimmed with Indiana stone and with interior wood work of hard wood with composition floors. Turner Brothers is one of the oldest of Terre Haute industries. The firm manufactures bottles, glass containers of various kinds and also paper boxes.

The Tygart Glass Company, whose factory at Grafton, W. Va., was destroyed by fire last spring, is remodeling the plant formerly occupied by the Pittsburgh Sheet Glass Company at Washington, Pa. The Tygart Company recently purchased the plant and expects to begin the manufacturing of containers early in 1927. Edward C. Stewart is president of the Tygart Valley Company; O. C. Noble, vice-president and general manager; E. A. Hinkins, secretary and treasurer, and J. S. Reese, manager of production.

The natural gas well brought in by the **Cambridge Glass Company,** Cambridge, Ohio, on the Brill Farm, Westland Township, Guernsey County, Ohio, and which, according to various reports, showed a flow of six to twenty-five million cubic feet per day, caught fire on Friday, October 29, while the well was being tubed, from a spark from an electric generator and was extinguished by the use of steam on the following Sunday, after a long and hard fight. Four boilers furnished steam for smothering the flame. A number of men were seriously injured by the flames.

The Acme Glass Company, Olean, N. Y., which was purchased some months ago by Samuel Kostin and Samuel Glickstein of the Eastern Glass Company, New York, have announced that the capacity of the plant will be doubled to take care of the orders for glassware which are said to be greatly in excess of the present capacity of the plant. According to a local report it was originally contemplated to move the machinery and equipment in the Acme factory to Wheeling, W. Va., where a factory had been purchased, but that following a study of the situation and in view of the enthusiastic cooperation of the citizens of Olean, it was finally decided to bring the equipment that had been purchased at Wheeling to Olean. The proposed new building is to take care of this equipment. The Acme Glass Company is manufacturing a great variety of ware, ranging from half ounce medicine bottles to one gallon vinegar jars and is specializing on packing, proprietary, soda and mineral bottles. From four to five cars per day are said to be shipped from the Acme plant. The work of preparing plans for the new extension is being done by the Toledo Engineering Company, Toledo, Ohio.

What Our Advertisers Are Doing

A French concern, **Tisseron Brothers & Company,** 14 Quai Gaston Boulet, Rouen, France, have begun advertising their Fontainbleau white sand and fire clay for the making of pots. They are sole exporting agents for Cie Industrielle des Sables de Nemours.

The Chapman-Stein Furnace Company, Mt. Vernon, Ohio, announce that the Owens Bottle Company has contracted for two more complete Chapman-Stein refractory tile recuperators to be used in connection with the revolving pot glass furnaces at their Huntington, W. Va., plant. Materials for three other recuperative pot furnaces were purchased some time ago, but operating conditions prevented their installation from being carried through. Production is now being interrupted long enough to start construction and install not only the three original furnaces, but also the two additional ones just ordered.

Personals

A. R. Payne, for the past eight years and until December 1 chief physicist of the Hazel-Atlas Glass Company, with headquarters at Clarksburg, W. Va., is now associated with the Fostoria Glass Company, Moundsville, W. Va.

Jack H. Waggoner, who for the past five years has been with the Libbey-Owens Sheet Glass Company at Hamilton, Canada, and Charleston, W. Va., has resigned and is now engaged on special work in glass problems at the Mellon Institute of Industrial Research, Pittsburgh, Pa.

Donald E. Sharp, 708 Erie County Bank Building, Buffalo, N. Y., who was formerly manager and scientific director of the Spencer Lens Company's Optical Glass Plant, and now is engaged in consulting practice for glass factories, left last week for Europe. He expects to visit France, Germany and England in interests of his work and for a pleasure trip.

Dr. Boris Stern, of the United States Department of Labor, is making a study of the labor productivity of the glass industry of the United States, and in the course of his work has visited numerous factories in the bottle, pressed and blown,

bulb, tubing, window and plate glass branches. It is expected that as a result of his findings the Department of Labor during the coming year will publish data showing the relative efficiency of hand and machine labor as employed in this industry.

Recent Deaths

Alfred G. Siegel

Alfred G. Siegel, president of the Huttig Sash and Door Company, died on November 1 at St. Louis, Mo.

John Borrey

John Borrey, pioneer manufacturer of window glass, died at the age of 78 years at his home in Fairmount, Ind., on October 23.

Henry E. Payne

Henry E. Payne, treasurer of the Dunbar Flint Glass Corporation, Dunbar, W. Va., died at the Johns Hopkins Hospital, Baltimore, Md., on October 23rd after a long illness, following an operation for an affection of the throat.

Albert A. Graeser

Albert A. Graeser, head of the Graeser Manufacturing Company, makers of decorated glassware, Pittsburgh, Pa., died at his home in that city on November 17.

Theodore W. Morris

Theodore W. Morris, retired, and one of the oldest glass distributors in the country, and formerly head of Theodore W. Morris & Company, 440 Canal Street, New York, now known as the Morris Glass Company, died on October 27.

Hamilton W. Stewart

Hamilton W. Stewart, vice-president of the Harbison-Walker Refractories Company, Pittsburgh, Pa., died on November 2 after a long illness. Mr. Stewart, who was 57 years of age at the time of his death, had been connected with the company for 37 years.

Cornelius J. Nolan

Cornelius J. Nolan, widely known throughout the industry, and president and general manager of the Inland Glass Company, Chicago, died in a hospital in that city on October 21. Mr. Nolan was 58 years old and had been active since his youth in the glass business, having been connected with the Libbey Glass Manufacturing Company, Toledo, in which he worked his way up to the position of factory manager. Several years ago he was active in organizing the Modern Glass Company, Toledo, which had but a short existence and after which Mr. Nolan became connected with the Inland Glass Company.

Coming Meetings

THE AMERICAN CERAMIC SOCIETY'S annual meeting will be held at the Book-Cadillac Hotel, Detroit, Mich., during the week February 14, 1927.

The annual meeting of the MIRROR MANUFACTURERS' ASSOCIATION and the NATIONAL GLASS DISTRIBUTORS ASSOCIATION will be held at the William Penn Hotel, Pittsburgh, December 7 and 8, 1926.

The national exhibition and convention of the ARTISTIC LIGHTING EQUIPMENT ASSOCIATION will be held at Cleveland, O., with headquarters at the Hollenden Hotel, January 31 to February 5, 1927.

Inquiries Received

For Further Information Address GLASS INDUSTRY

345. (From Chile) We shall be glad if you will kindly put us in touch with any firm who sells satisfactory crushers or grinders for quartz which will turn out a more or less standard grain with a minimum percentage of loss. (October 8)

346. Can you inform us where we can obtain small thin wall glass balls ranging from 1½ to 2 inches in diameter. (Nov. 1)

What the World Wants

Australia: 22845, glassware; 22931, crystal glass.
Nicaragua: 22989, glass.
Salvador: 23016, glassware.
Chile: 23004, glassware for table use.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE NOV. 23, 1926.
Reported by Moore, Leonard & Lynch, Union Trust Building, Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Machine, com.	...	...	60
American Window Glass Machine, pfd..	81	84	81
American Window Glass, pfd.....	...	...	108
United States Glass.....	...	...	15½
Pittsburgh Plate Glass, com.....	268	270	270
Standard Plate Glass, com.....	...	...	3¾
Standard Plate Glass:			
Preferred cumulative	23	27	25
Prior preferred	7	...	80½

TOLEDO STOCK EXCHANGE
November 23, 1926.

	Bid	Asked	Last
Owens Bottle Machine, com.....	115	118½	115
Libbey-Owens Sheet Glass, com.....	138½	140	140
Libbey-Owens Sheet Glass, pfd.....	115	...	115

WHEELING STOCK EXCHANGE
November 23, 1926.

	Bid	Asked	Last
Hazel-Atlas	...	...	50
Imperial	...	...	72
Fostoria	...	...	150
Central	...	...	75

READERS WANTS AND OFFERS

GLASS FACTORY MANAGER

WANTED: Position as manager in glass factory by man now employed but desires change to position offering good future. Sixteen years as executive in automatic factory. Married, age 40. Address, MANAGER, care GLASS INDUSTRY, 50 Church Street, New York.

CHINA AND GLASS DECORATOR

WANTED:—Position as china and glass painter specializing in decorating pharmaceutical bottles, shields of different kinds, china and enamel, hotel and other ware. Desires permanent eventually (leading) position. Address DECORATOR, care GLASS INDUSTRY, 50 Church Street, New York.

FOR SALE

Glass annealing and bending furnace, inside dimensions 30" x 48", practically new; also new imported French enameling furnace; very cheap. Room 808, 105 West 40th St., New York. "Pennsylvania 2460."

AMERICAN REPRESENTATIVE WANTED

Large fire clay and silica brick factory in Germany desires for the sale of its prime quality

GLASS POT CLAY (From Cassel)

a representative, well introduced in the American glass industry.

Interested parties are requested to submit in first letter references and detailed information regarding previous activities, under "Box 2," care GLASS INDUSTRY, 50 Church Street, New York.

Current Prices of Glass-Making Materials

November 23, 1926

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid:			
Citric	lb.	.44½	.44½
Hydrochloric (HCl) 20° tanks, per 100 lb.		.95-1.05	..
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13
52% and 48%	lb.	..	.10½-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.00-16.00	..
Tartaric	lb.	.27½	.28½
Alcohol, denatured	gal.	..	.40
Aluminum hydrate (Al $(OH)_3$)	lb.	.06	.07
Aluminum oxide (Al_2O_3)	lb.	..	.05
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	..	.03½
Antimony, metallic (Sb)	lb.	..	.14
Antimony oxide (Sb_2O_3)	lb.	..	.16½
Antimony sulphide (Sb_2S_3)	lb.	.15	.16½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.03½	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	49.00-55.00	51.00-58.00
Natural, powdered, imported	ton	42.00-44.00	45.00-46.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.07½	.07¾
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04	.04¾-.04¾
Boric acid (H_3BO_3)	lb.	.08	.08½-.09¼
Refined	lb.	.08-.09½	.08½-.10¾
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.05-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.28	.29
Cobalt oxide (Co_3O_4)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.20
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	..	.30
Cryolite ($Na_3Al F_6$) Natural Greenland Kryolith)	lb.	..	.09¼-.09½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		1.20	1.35
Feldspar—			
100 mesh	ton	11.00-20.00	16.00-22.00
80 mesh	ton	13.50	..
40 mesh	ton	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	40.00	40.00
" " 90%	ton	38.00	..
Formaldehyde	lb.	.10¼	.10¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02-.03
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	..	.11¼
Litharge (PbO)	lb.	..	.10¾
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls. Per bbl.		2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.04	.04½
light (in bbls.)	lb.	.22	.24
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06¼	.06¾
Manganese 85% (MnO_2)	lb.	.04½	.05
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08	.08¼
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.06¾
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07¼	.07¾
Potassium nitrate (KNO_3) (gran.)	lb.	.05¾-.06	.06⅛-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.14	.14½
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.20
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	20.00-22.00	25.00-35.00
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz.	..	.40
Soda ash (Na_2CO_3) dense, 58%—			
Bulk Flat per 100 lb.		1.35-1.40	..
Bulk, on contract Flat per 100 lb.		1.35	..
In barrels Per 100 lb.		1.69	2.40
In bags Per 100 lb.		1.45	..
Spot orders .05 per 100 lbs higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¼	.06¾
Sodium hydrate (NaOH) (caustic soda) Per 100 lb.		3.60	4.16
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04¼
95 per cent. Per 100 lb.		2.56	2.80
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.10-1.30
Sulphur (S)—			
Flowers, in bbls. Per 100 lb.		3.45	3.80-4.00
Flowers, in bags Per 100 lb.		3.10	3.45-3.65
Flour, heavy, in bbls. Per 100 lb.		2.85	3.20-3.40
Tin chloride ($SnCl_2$)) (crystals)	lb.	..	.47
Tin oxide (SnO_2) in bbls.	lb.	..	.70
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.30-2.25
Zinc oxide (ZnO)	lb.	.07½	.07¾

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to October 23, 1926

	September 1925 Quantity	September 1925 Value	September 1926 Quantity	September 1926 Value	Nine Months Ending September 1925 Quantity	Nine Months Ending September 1925 Value	Nine Months Ending September 1926 Quantity	Nine Months Ending September 1926 Value
Glass and glass products (total)	.....	663,771	.....	837,212	.....	6,297,203	.....	6,726,896
Plate and window glass—								
Window glass, common, box 50 sq. ft.	2,106	11,781	2,843	21,316	20,220	115,032	24,260	141,571
Plate glass, unsilvered, sq. ft.	92,759	30,813	35,060	14,386	1,047,381	296,034	810,632	212,199
Other window and plate glass lbs.	293,185	30,242	87,398	14,706	1,750,985	205,341	1,649,991	177,394
Glass containers (bottles, vials and jars)	.....	215,783	.....	307,017	.....	2,223,773	.....	2,273,965
Table glassware, plain	.....	143,614	.....	148,535	.....	1,297,966	.....	1,220,758
Table and other glassware, cut or engraved	.....	9,553	.....	15,123	.....	111,596	.....	132,503
Lamp chimneys and lantern globes lbs.	92,981	21,389	120,131	25,825	1,439,045	261,161	1,634,853	305,460
Globes and shades for lighting fixtures lbs.	117,702	39,307	175,912	61,856	1,162,828	360,096	1,301,652	430,516
Chemical glassware lbs.	19,510	15,783	21,134	18,123	168,611	139,908	164,107	150,843
Electrical glassware, except for lighting lbs.	157,599	22,776	176,413	35,185	2,245,652	209,842	4,170,378	372,682
Other glassware	.....	122,730	.....	175,140	.....	1,076,454	.....	1,309,005

IMPORTS

Corrected to October 23, 1926

Glass and glass products (total)	.....	1,444,625	.....	1,809,698	.....	13,083,823	.....	15,511,841
Cylinder, crown and sheet—								
Unpolished dut. lbs.	2,079,853	111,681	6,501,339	228,330	35,381,329	1,874,362	60,590,401	2,426,516
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	33,823	.....	37,423	.....	420,441	.....	413,917
Plate glass dut. sq. ft.	1,259,552	506,750	2,005,466	655,459	13,138,341	5,939,374	20,260,357	6,681,322
Containers—bottles, vials, etc dut.	.....	15,349	.....	17,737	.....	132,482	.....	207,504
Table and kitchen utensils dut.	.....	10,554	.....	12,997	.....	90,919	.....	66,867
Glassware, cut or decorated dut.	.....	263,806	.....	308,544	.....	1,607,619	.....	2,037,113
Blown glassware, n.e.s.—								
Bottles, ornaments, etc dut.	.....	233,787	.....	281,041	.....	969,151	.....	1,293,940
Bulbs for electric lamps dut. No.	1,694,508	16,376	2,408,676	25,253	14,096,703	145,483	15,093,452	166,874
Chimneys, globes, shades, etc dut.	.....	84,087	.....	75,227	.....	809,658	.....	755,846
Articles and utensils for chemical, scientific and experimental purposes dut.	.....	47,316	.....	48,714	.....	265,109	.....	423,088
Other glassware dut.	.....	121,096	.....	118,973	.....	829,225	.....	1,038,854

DIXON

HARDWARE—"EVERYTHING FOR THE GLASSHOUSE."

LADLES—ALL KINDS AND SIZES

DUST CONVEYING SYSTEMS FOR BATCH PLANTS.
IRON—"VANAD" FOR MOLDS AND PLUNGERS.
XCELLENT QUALITY IN EVERYTHING.
OUR OWN BLOCKS AND REFRACTORY MATERIALS.
NEW TYPE MAYERS VERTICAL SAND DAMPERS.

COAL HANDLING AND CONVEYING EQUIPMENT.
OILBURNING EQUIPMENT
MUFFLE LEHRS—ALL KINDS—ANY FUEL.
PRODUCERS AND PRODUCER PIPING.
AIR REVERSING VALVES—WATER SEAL.
NUMEROUS OTHER ITEMS.
YOUR FULL NEEDS.

Best Glass Melting Furnaces

"Everything for the Glasshouse"

Office and Works—Rosslyn Station, Carnegie, Pa.

Mail Address—P. O. Box 140, Pittsburgh, Pa. Cable Address: "Loomis," Pittsburgh.

European Branch—King, Taudevin & Gregson, Ltd., Melbourne Chambers, Cambridge Street, Sheffield, England. Cable Address—Pyro, Sheffield.

EQUIPMENT

HARTFORD-EMPIRE COMPANY

HARTFORD : - : CONNECTICUT

GLASS WORKING MACHINERY

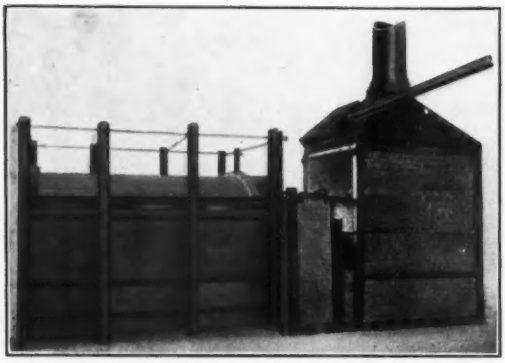
LICENSORS OF

HARTFORD AUTOMATIC

FEEDERS :-: FORMING MACHINES :-: LEHRS

GLASS WORKING MACHINERY DEVELOPED FOR SPECIAL PURPOSES

CONSULTING ENGINEERS FOR MANUFACTURERS OF GLASSWARE



If You Are Really Interested

in obtaining the utmost in Fuel Economy, you should
INSTALL

THE AMCO RECUPERATOR

Scientifically Sound Design

10 to 50% fuel saving.
10 to 50% increase in melting capacity.

THE AMSLER-MORTON CO.
FULTON BLDG. PITTSBURGH, PA.

CARR-LOWREY GLASS CO. ORDERED THEIR THIRD THIS WEEK

There is Manufacturing Economy In Using Diamond 58% Soda Ash

THE purity and uniformity of Diamond 58% High Test Soda Ash is recognized throughout the glass industry.

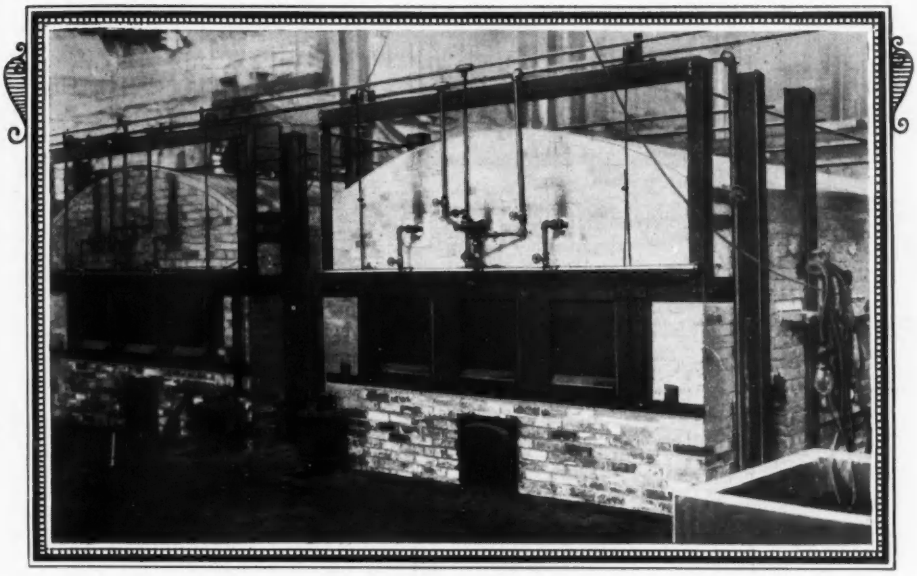
It is a product of unvarying composition—guaranteed over 99% pure and your constant assurance that the highest quality standards of glass manufacture will be maintained.

Every carload is manufactured to an exacting standard and guaranteed by analysis to conform to these quality specifications.

ALKALI

58% Soda Ash—76% Caustic Soda
Modified Soda—Special Alkalies
Bicarbonate of Soda

DIAMOND ALKALI COMPANY
PITTSBURGH, PENNSYLVANIA



Down Go Operating Costs

THE addition of a 4½-inch course of Nonpareil Insulating Brick around the outside walls and over the fire boxes of the eight lehrs illustrated above reduced the fuel cost more than 25%.

During the year previous to their insulation, the daily consumption of natural gas was 175,000 cu. ft. After the Nonpareil Brick were installed, consumption dropped to 128,000 cu. ft., a saving of 47,000 cu. ft. every 24 hours, or more than $5,000.00 a year.

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Lehrs, pot arches, regenerators, recuperators, boiler settings and producer gas mains can be made practically heattight with Nonpareil Brick. Complete information on their proper use is contained in the book, "Nonpareil Insulating Brick," a copy of which will be mailed on request.

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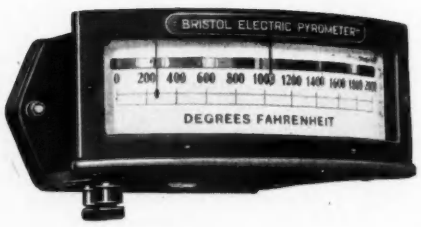

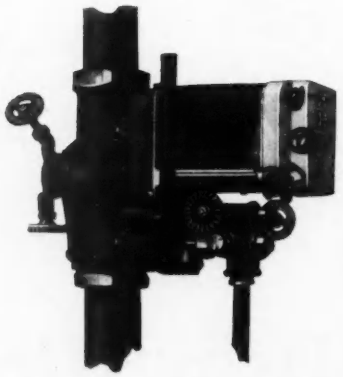

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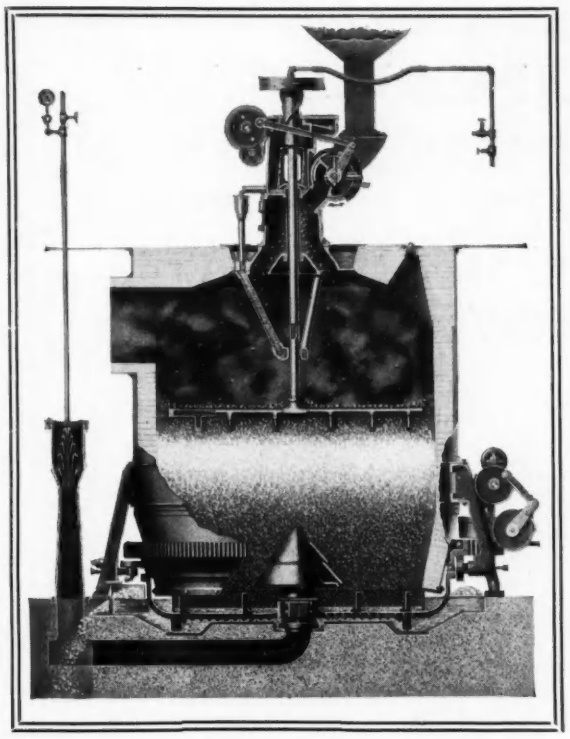

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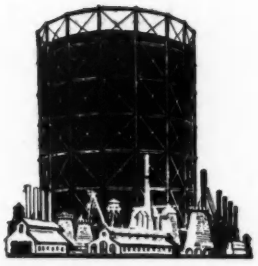

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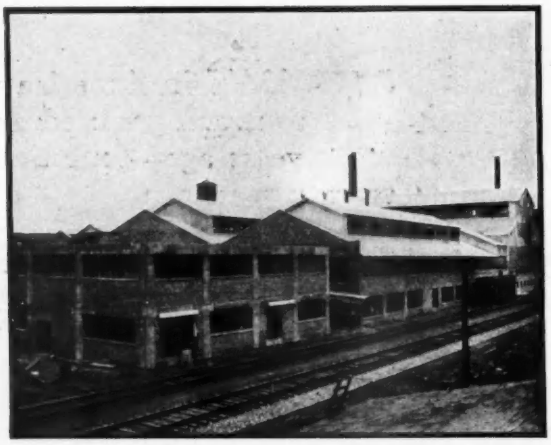

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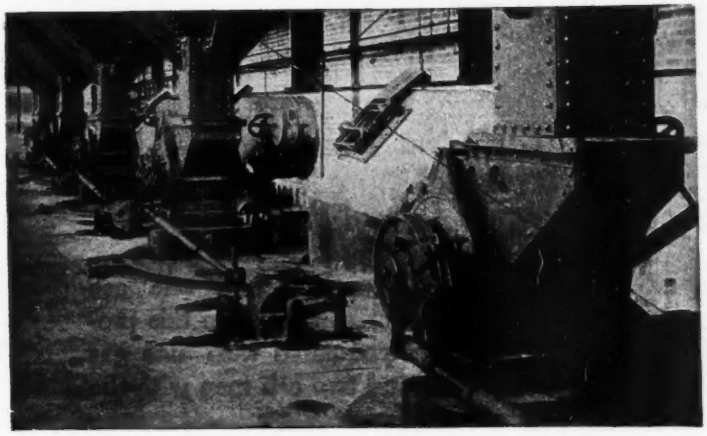

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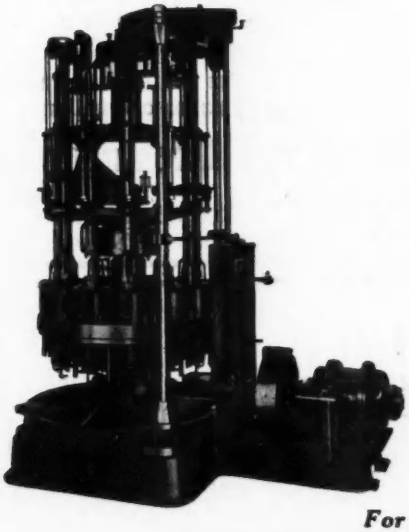

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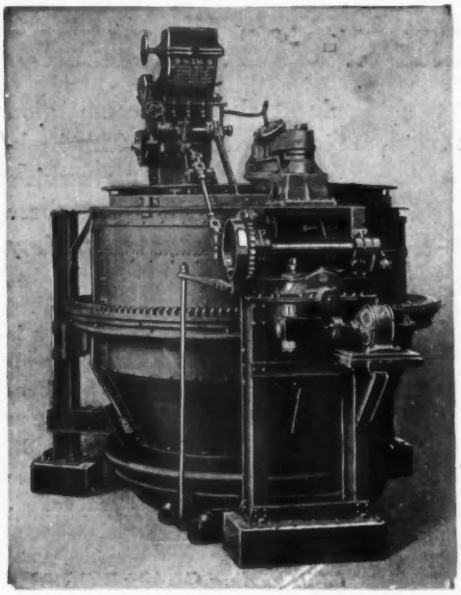

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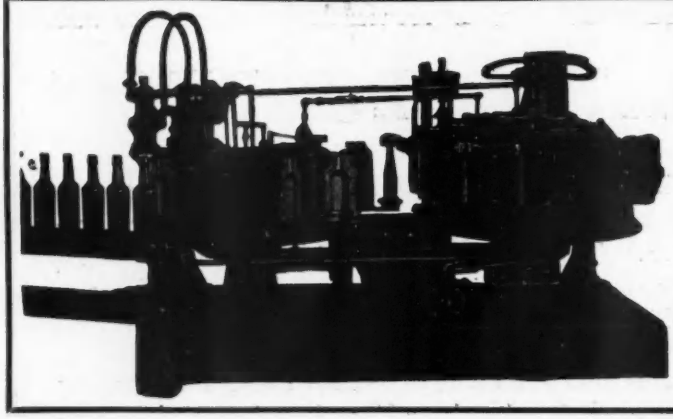

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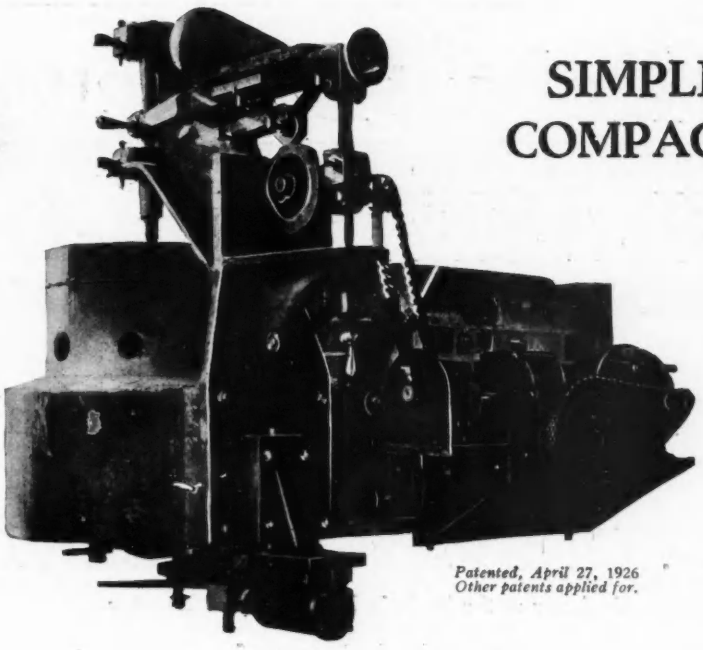

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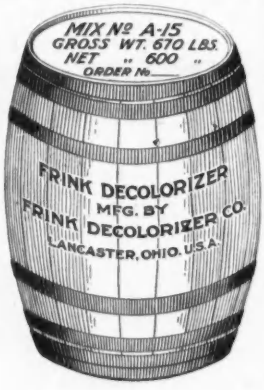

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